DOCUMENT RESUME

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TITLE	Fire Protection Specialist, Blocks I, II, & III, 17-2. Military Curriculum Materials for Vocational and Technical Education.
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IDENTIFIERS	*Emergency Medical Services; Fire Extinguishers; Fires; Military Curriculum Project

ABSTRACT

This military-developed text contains the first three blocks of a five-block course for use in training fire protection specialists. Covered in the individual volumes are the following topics: fire protection objectives and responsibilities (fire protection and occupational safety, extinguishing agents, principles and theory of combustion, natural cover fires, portable extinguishers, and protective clothing); breathing apparatus, rescue carries, and emergency first aid (first aid, treating shock, swallowed objectives and choking, poisoning and drugs, wounds, bandaging and splinting, sudden illness, respiratory emergencies, and cardiopulminary resuscitation); and structural firefighting equipment and accessories (rescue vehicle equipment, pre-fire plans, rescue, alarm room procedures and operations structural firefighting accessories, and fire protection hydraulics). This half of the course includes both teacher and student materials. Among the printed instructor materials provided are lesson plans with an outline of the teaching steps and a plan of instruction detailing the units of instruction, objectives, duration of the lessons, and supportive materials needed. Student materials include three study guides with objectives, text readings, and review questions; three workbooks with exercises; and one programmed text on hydraulics. (MN)

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MILITARY CURRICULUM MATERIALS

The military-developed curriculum materials in this course package were selected by the National Center for Research in Vocational Education Military Curriculum Project for dissemination to the six regional Curriculum Coordination Centers and other instructional materials agencies. The purpose of disseminating these courses was to make curriculum materials developed by the military more accessible to vocational educators in the civilian setting.

The course materials were acquired, evaluated by project staff and practitioners in the field, and prepared for dissemination. Materials which were specific to the military were deleted, copyrighted materials were either omitted or approval for their use was obtained. These course packages contain curriculum resource materials which can be adapted to support vocational instruction and curriculum development.

The National Center Mission Statement

The National Center for Research in Vocational Education's mission is to increase the ability of diverse agencies, institutions, and organizations to solve educational problems relating to individual career planning, preparation, and progression. The National Center fulfills its mission by:

- Generating knowledge through research
- Developing educational programs and products
- Evaluating individual program needs and outcomes
- Installing educational programs and products
- Operating information systems and services
- Conducting leadership development and training programs

FOR FURTHER INFORMATION ABOUT
Military Curriculum Materials
WRITE OR CALL
Program Information Office
The National Center for Research in Vocational Education
The Ohio State University
1960 Kenny Road, Columbus, Ohio 43210
Telephone: 614/486-3655 or Toll Free 800/848-4815 within the continental U.S. (except Ohio)

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FOR RESEARCH IN VOCATIONAL EDUCATION
The Ohio State University · 1960 Kenny Road · Columbus, Ohio 43210
Tel (614) 486-3655 Cable: CTVOCEDOSU/Columbus, Ohio

Military Curriculum Materials for Vocational and Technical Education

Information and Field Services Division

The National Center for Research in Vocational Education

Military Curriculum Materials Dissemination Is . . .

an activity to increase the accessibility of military-developed curriculum materials to vocational and technical educators.

This project, funded by the U.S. Office of Education, includes the identification and acquisition of curriculum materials in print form from the Coast Guard, Air Force, Army, Marine Corps and Navy.

Access to military curriculum materials is provided through a "Joint Memorandum of Understanding" between the U.S. Office of Education and the Department of Defense.

The acquired materials are reviewed by staff and subject matter specialists, and courses deemed applicable to vocational and technical education are selected for dissemination.

The National Center for Research in Vocational Education is the U.S. Office of Education's designated representative to acquire the materials and conduct the project activities.

Project Staff:

Wesley E. Budke, Ph.D., Director
National Center Clearinghouse

Shirley A. Chase, Ph.D.
Project Director

What Materials Are Available?

One hundred twenty courses on microfiche (thirteen in paper form) and descriptions of each have been provided to the vocational Curriculum Coordination Centers and other instructional materials agencies for dissemination.

Course materials include programmed instruction, curriculum outlines, instructor guides, student workbooks and technical manuals.

The 120 courses represent the following sixteen vocational subject areas:

- Agriculture
- Aviation
- Building & Construction Trades
- Clerical Occupations
- Communications
- Drafting
- Electronics
- Engine Mechanics
- Food Service
- Health
- Heating & Air Conditioning
- Machine Shop
- Management & Supervision
- Meteorology & Navigation
- Photography
- Public Service

The number of courses and the subject areas represented will expand as additional materials with application to vocational and technical education are identified and selected for dissemination.

How Can These Materials Be Obtained?

Contact the Curriculum Coordination Center in your region for information on obtaining materials (e.g., availability and cost). They will respond to your request directly or refer you to an instructional materials agency closer to you.

CURRICULUM COORDINATION CENTERS

EAST CENTRAL
Rebecca S. Douglass
Director
100 North First Street
Springfield, IL 62777
217/782-0759

MIDWEST
Robert Patton
Director
1515 West Sixth Ave.
Stillwater, OK 74704
405/377-2000

NORTHEAST
Joseph F. Kelly, Ph.D.
Director
225 West State Street
Trenton, NJ 08625
609/292-6562

NORTHWEST
William Daniels
Director
Building 17
Airdustrial Park
Olympia, WA 98504
206/753-0879

SOUTHEAST
James F. Shill, Ph.D.
Director
Mississippi State University
Drawer DX
Mississippi State, MS 39762
601/325-2510

WESTERN
Lawrence F. H. Zane, Ph.D.
Director
1776 University Ave.
Honolulu, HI 96822
808/948-7834

FIRE PROTECTION SPECIALIST, BLOCKS I, II, & III

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Block II - Breathing Apparatus, Rescue Carries, And Emergency First Aid

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FIRE PROTECTION SPECIALIST, BLOCKS I, II, AND III

Classroom Course

17-2

Developed by:

United States Air Force

Development and Review Dates:

July 7, 1975

D.O.T. No.:

373.168

Occupational Area:

Public Service

Target Audiences:

Grades 13-adult

Print Pages:

381

Cost:

Availability:

Military Curriculum Project, The Center for Vocational Education, 1960 Kenny Rd., Columbus, OH 43210

Contents:	Type of Materials:						Instructional Design:				Type of Instruction:	
	Lesson Plans:	Programmed Text:	Student Workbook:	Handouts:	Text Materials:	Audio-Visuals:	Performance Objectives:	Tests:	Review Exercises:	Additional Materials Required:	Group Instruction:	Individualized:
			No. of pages									
Block I – *Fire Protection Objectives and Responsibilities*	●		12		●	*	●	*	●	*	●	
Block II – *Breathing Apparatus, Rescue Carries and Emergency First Aid*	●		2		●	*	●	*	●	*	●	
Block III – *Stuctural Firefighting Equipments and Accessories*	●	●	26		●	*	●	*	●	*	●	●

* Materials are recommended but not provided.

THE CENTER FOR VOCATIONAL EDUCATION
THE OHIO STATE UNIVERSITY

UUI

Expires July 1, 1978

Course Description:

This is the first half of a course to train the fire protection specialist. It provides training in firefighting and fire protection techniques for use with aircraft , structural and materials fires, and other emergencies. Topics covered in this half of the course include introductions to safety procedures, protective clothing, first aid, emergency procedures, and firefighting equipment. This half of the course contains three blocks covering 94 hours of instruction.

Block I – *Fire Protection Objectives and Responsibilities* contains seven lessons covering 28 hours of instruction. Five additional lessons on study habits, communications security, military mission and organization, missiles and weapons fire protection, and publications were deleted. The remaining lessons topics and respective hours follow:

Fire Protection and Occupational Safety (3 hours)
Extinguishing Agents (3 hours)
Principles and Theory of Combustion (6 hours)
Natural Cover Fires (3 hours)
Miscellaneous Firefighting (3 hours)
Operation and Servicing of Portable Extinguishers (6 hours)
Protective Clothing (4 hours)

Block II – *Breathing Apparatus, Rescue Carries and Emergency First Aid* contains thirteen lessons covering 34 hours of instruction.

Block II, Orientation (.5 hours)
Breathing Apparatus (5.5 hours)
Rescue Carries (4 hours)
Introduction to First Aid (1 hour)
Identification and Treatment of Shock (1 hour)
Swallowed Objects and Choking (1 hour)
Poisoning and Drugs (1 hour)
Identification and Treatment of Wounds (2 hours)
Identification and Treatment of Specific Injuries (2 hours)
Dressing, Bandaging and Splinting (6 hours)
Sudden Illness (1 hour)
Respiratory Emergencies and Artificial Respiration (5 hours)
Cardiopulmonary Resusciation (4 hours)

Block III – *Structural Firefighting Equipment and Accessories* has seven lessons covering 32 hours of instruction. Many of the pieces of equipment mentioned in these lessons are identified by military numbers, but the lessons can be adapted for similar equipment used in the civilian sector.

Blocks III and IV, Orientation (.5 hours)
Operations, Maintenance and Mounted Equipment on the P-10 Rescue Vehicle (5.5 hours)
Pre-Fire Plans (2 hours)
Miscellaneous Rescue (4 hours)
Alarm Room Procedures and Operation (6 hours)
Structural Firefighting Accessories (8 hours)
Fire Protection Hydraulics (6 hours)

This half of the course contains both teacher and student materials. Printed instructor materials include lesson plans with an outline of the teaching steps and a plan of instruction detailing the units of instruction, objectives, duration of the lessons, and support materials needed. Student materials include three study guides with objectives, text readings, and review questions; three workbooks with exercises; and one programmed text on hydraulics.

Additional military manuals and commercially produced texts are recommended as references or texts, but these are not provided. Audiovisual aids suggested for use with the entire course consist of 29 films and 14 slide sets. This material can be presented in a group instruction setting or adapted for individualized study.

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POI 3ABR57130-1
(PDS Code AJ8)

PLAN OF INSTRUCTION
(Technical Training)

17-2

FIRE PROTECTION SPECIALIST

AIR TRAINING COMMAND

CHANUTE TECHNICAL TRAINING CENTER

7 July 1975 - Effective 7 July 1975 with Class 750707

MODIFICATIONS

Pages 1 & 2 of this publication has (have) been deleted in adapting this material for inclusion in the "Trial Implementation of a Model System to Provide Military Curriculum Materials for Use in Vocational and Technical Education." Deleted material involves extensive use of military forms, procedures, systems, etc. and was not considered appropriate for use in vocational and technical education.

PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
~~c. Without reference, identify basic facts concerning the progression in career ladder 571X0 with 80 percent accuracy.~~ ~~d. Without reference, identify basic facts and principles concerning the duties and responsibilities of AFSC 57130/50/70/90 with 80 percent accuracy.~~		**Audio Visual Aids** Charts **Training Methods** Discussion/Demonstration (6 hrs) **Instructional Environment/Design** Classroom (6 hrs) **Instructional Guidance** Define relationship between Air Force Career Program, the Air Force Fire Protection Career Field, and how they relate to the overall mission of the Air Force. Answer questions on the Career Field Progression PT as required. Stress energy and materials conservation.
4. Fire Protection Occupational Safety a. Without reference, identify basic facts and principles relating to the objectives of industrial safety with 80 percent accuracy. b. Without reference, identify safe and unsafe procedures involved in performing station duties with 80 percent accuracy. c. Without reference, identify safe and unsafe procedures involved in the wearing of protective clothing with 80 percent accuracy. d. Without reference, identify safe and unsafe procedures pertaining to mounting fire protection vehicles with 80 percent accuracy. e. Without reference, identify safe and unsafe procedures involved in fighting fires with 80 percent accuracy.	3 Day 3	**Column 1 Reference** — **STS Reference** 4a — 3a 4b — 3b(2) 4c — 3b(5) 4d — 3b(3) 4e — 3b(1) **Instructional Materials** 3ABR57130-1-SG-104, Fire Protection Occupational Safety AFR 92-1 **Audio Visual Aids** 35mm Slides, Carousel Set #104, Fire Protection Occupational Safety Film: TF 1-8193, "Meet Mr. Noise" **Training Methods** Discussion/Demonstration (3 hrs) **Instructional Environment/Design** Classroom (3 hrs)

PLAN OF INSTRUCTION NO. 3ABR57130-1	DATE 7 Jul 75	BLOCK NO. I	PAGE NO. 3

PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	DURATION (HOURS) 2	3 SUPPORT MATERIALS AND GUIDANCE
		Instructional Guidance Relate the subject to the fire protection career field. Safety during all phases of fire protection operations must be observed due to extreme hazards which may be encountered. Cover noise hazards associated with the Fire Protection Career Field. Stress energy and materials conservation.
5. Extinguishing Agents a. Without reference, identify principles relating to suppression, control and extinguishment of fires. Eighty percent of the principles must be identified correctly. b. Without reference, identify the characteristics of extinguishing agents by matching proper agents to classes of fires and associated hazards with 80 percent accuracy.	3 Day 3	Column 1 Reference — STS Reference 5a — 5b 5b — 5c Instructional Materials 3ABR57130-1-SG-105, Extinguishing Agents AFR 92-1 Audio Visual Aids Charts Training Equipment Trainer: Electrical Conductivity, S/N02 (10) Laboratory Equipment (10) Samples of Extinguishing Agents (10) Training Methods Discussion/Demonstration (3 hrs) Instructional Environment/Design Classroom (2 hrs) Laboratory (1 hr) Instructional Guidance Stress safety in use of CO_2 in confined areas and water on electrical fires. Assure that the laboratory equipment and trainer are properly cleaned up after the demonstration. Notify the instructor-supervisor when the samples of extinguishing agents run low. Stress energy and materials conservation.

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PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
6. Principles and Theory of Combustion a. Without reference, identify principles relating to chemistry and physics of combustion. Eighty percent of the principles must be identified correctly. b. Without reference, identify characteristics and hazards of flammable materials with 80 percent accuracy.	6 Day 4	Column 1 Reference — STS Reference 6a — 5a 6b — 5d Instructional Materials 3ABR57130-1-SG-106, Principles and Theory of Combustion AFR 92-1 Audio Visual Aids Film: TFI 5277B, "Fire Prevention, Know Your Hazards" Film: CFL6, "Science of Fire" Charts Training Equipment Trainers: Fire Triangle, 3168 (10) Combustible Hazard Kit, 0004 (10) Vapor Trough, 3163 (10) Desk, Laboratory, 8250 (10) Oxygen and Bottle (10) Various Laboratory Test Items (10) Gloves (10) Flammable Materials (10) Butane and Bottle (10) Training Methods Discussion/Demonstration (5 hrs) Performance (1 hr) Instructional Environment/Design Classroom (4 hrs) Laboratory (2 hrs)

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PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
		Instructional Guidance Safety procedures during all phases of demonstration should be stressed. Point should also be made that all demonstrations are simulations of actual situations which can and will occur in the field. Keep students at a safe distance from the laboratory desk. Inform the class leader that he is to notify the instructor-supervisor should the instructor need assistance in an emergency. Stress energy and materials conservation.
7. Natural Cover Fires a. Without reference, identify principles involved in natural cover firefighting. Eighty percent of the principles must be identified correctly. b. Without reference, identify the principles involved in various methods of controlling and extinguishing natural cover fires. Eighty percent of the principles must be identified correctly. c. Without reference, identify principles relating to the tools and equipment used in natural cover firefighting. Eighty percent of the principles must be identified correctly.	3 Day 5	**Column 1 Reference** / **STS Reference** 7a / 7a 7b / 7c 7c / 7b **Instructional Materials** 3ABR57130-1-SG-107, Natural Cover Fires AFR 92-1 **Audio Visual Aids** Film: TVL 57-20, "Firefighting Hand Tools" Charts **Training Methods** Discussion/Demonstration (3 hrs) **Instructional Environment/Design** Classroom (3 hrs) **Instructional Guidance** Stress that firefighters should not start a back fire without the approval of the senior firefighter present. Stress that wind, contour of the land, type and abundance of fuel will often determine the method used to control and/or extinguish a natural cover fire. Stress energy and materials conservation.

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PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
8. Miscellaneous Firefighting a. Without reference, identify principles involved in miscellaneous firefighting. Eighty percent of the principles must be identified correctly. b. Without reference, identify the principles involved in various methods of controlling and extinguishing miscellaneous fires. Eighty percent of the principles must be identified correctly. c. Without reference, identify principles related to the tools and equipment used in miscellaneous firefighting. Eighty percent of the principles must be identified correctly.	3 Day 5	**Column 1 Reference** — **STS Reference** 8a — 7a 8b — 7c 8c — 7b **Instructional Materials** 3ABR57130-1-SG-108, Miscellaneous Firefighting AFR 92-1 **Audio Visual Aids** 35mm Slides, Carousel Set #108, Miscellaneous Firefighting **Training Methods** Discussion/Demonstration (3 hrs) **Instructional Environment/Design** Classroom (3 hrs) **Instructional Guidance** Define the difference between a miscellaneous type fire from other types of fire which may be encountered in the Air Force. Identify basic types and tactics on how to combat a miscellaneous type fire. Stress energy and materials conservation.
9. Missiles and Weapons Fire Protection a. Given pictures of 10 symbols and markers relating to firefighting tactics, identify each symbol and marker with minimum instructor assistance. b. Without reference, identify the hazards created by weapons and the principles and tactics of fighting fires containing weapons. Eighty percent of the hazards, principles and tactics must be identified correctly.	6 Day 6	**Column 1 Reference** — **STS Reference** 9a — 8b 9b — 8a(1) 9c — 8a(2) 9d — 8a(3) 9e — 8a(4) 9f — 8c **Instructional Materials** 3ABR57130-1-SG-109, Missiles and Weapons Fire Protection 3ABR57130-1-WB-109, Missiles and Weapons Fire Protection 3ABR57130-1-PT-109, Radiation Hazards for Firefighters AFR 92-1

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PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION HOURS 2	SUPPORT MATERIALS AND GUIDANCE 3
c. Without reference, identify the hazards created by munitions and principles and tactics of fighting fires containing munitions. Eighty percent of the hazards, principles and tactics must be identified correctly. d. Without reference, identify the hazards created by explosives and the principles and tactics of fighting fires containing explosives. Eighty percent of the hazards, principles, and tactics must be identified correctly. e. Without reference, identify the hazards created by NBC materials and the principles and tactics of fighting fires containing NBC materials. Eighty percent of the hazards, principles and tactics must be identified correctly. f. Without reference, identify decontamination procedures used when various types of contamination hazards are encountered with 80 percent accuracy.		**Audio Visual Aids** Film: TFI 5423, "Atomic Weapons and Fire" Charts **Training Methods** Discussion/Demonstration (5 hrs) Performance (1 hr) **Instructional Environment/Design** Classroom (4.5 hrs) Laboratory (1.5 hrs) **Instructional Guidance** Use symbols and markers from the workbook. Stress importance to each individual of knowing and understanding when and why symbols, markers and placards are used. Explain the major hazard to the firefighter when special weapons are involved in an accident or incident that involves high explosives. Stress energy and materials conservation.
10. Operation and Servicing of Portable Extinguishers a. Given a portable fire extinguisher and WB, inspect the extinguisher in accordance with workbook checklist. b. Without reference, identify procedures for repairing or replacing parts on extinguishers. Eighty percent of the procedures must be identified correctly.	6 Day 7	**Column 1 Reference** — **STS Reference** 10a — 6a 10b — 6d 10c — 6b 10d — 3b(1), 6c **Instructional Materials** 3ABR57130-1-SG-110, Operation and Servicing of Portable Extinguishers 3ABR57130-1-WB-110, Operation and Servicing of Portable Extinguishers AFR 92-1

PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
c. Given a portable fire extinguisher and WB, recharge the extinguisher in accordance with workbook checklist, while observing all safety precautions. d. Given a portable fire extinguisher and WB, perform operational test on extinguisher by completely extinguishing a fire with minimum instructor assistance. All safety precautions will be observed.		Audio Visual Aids Film: FLC 16/101, "Portable Extinguishers" Charts Training Equipment Standard Air Force Extinguishing Agents (5) Floor Scales (10) Hi Pressure CO_2 Transfer Pump (10) Tilting Rack (10) Standard Air Force Fire Extinguishers (5) Hi Pressure CO_2 Bottles Miniature Burn Pans (5) Training Methods Discussion/Demonstration (2 hrs) Performance (4 hrs) Instructional Environment/Design Classroom (1.5 hrs) Laboratory (4.5 hrs) Instructional Guidance Stress safety while servicing extinguishers. Allow students to operationally test extinguishers on a small live fire. No protective clothing is necessary because during actual use of extinguishers protective clothing would normally not be used. Assure that the miniature burn area is "policed" after operations. Stress energy and materials conservation.
11. Fire Protection Publications a. Given AFR 0-2, locate standard publication numbers and titles in index type publications with minimum instructor assistance.	6 Day 8	Column 1 Reference STS Reference 11a 4d 11b 4e 11c 4f 11d 4b 11e 4c 11f 4a

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PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	DURATION (HOURS) 2	3 SUPPORT MATERIALS AND GUIDANCE
b. Given an IFSTA manual, locate and record the page numbers for specific items of information in commercial publications. No errors are permitted. c. Given a standard AF publication, locate and record the page numbers for specific items of information with minimum instructor assistance. d. Given Technical Order Index 0-2-1, TO 0-1-13 and TO 0-1-36, locate technical order numbers and titles in index type technical orders with minimum instructor assistance. e. Given TO 36A12-8-13-1, locate and record the page numbers for specific maintenance operations and inspection data with minimum instructor assistance. f. Without reference, identify basic procedures for maintaining reference files with 80 percent accuracy.		Instructional Materials 3ABR57130-1-SG-111, Fire Protection Publications 3ABR57130-1-WB-111, Fire Protection Publications AFR 0-2, Numerical Index of Standard and Recurring Air Force Publications TO 0-2-1, Alphabetical Listing of Equipment and Technical Publications Number Groups TO 0-1-36, Numerical Index (36 Category) TO 0-1-13, Numerical Index (13 Category) TO 36A12-8-13-1, Truck, Firefighting Type, A/S32P-2 Example, IFSTA Manual AFR 92-1 Audio Visual Aids Film: TFI 5890, "Right the First Time" Charts Training Methods Discussion/Demonstration (4 hrs) Performance (2 hrs) Instructional Environment/Design Classroom (3 hrs) Laboratory (3 hrs) Instructional Guidance Emphasize that technical data should be the prime source of information for all phases of planning and operation for all Air Force personnel. Indexes used do not have to be current; only scope is taught. However, all indexes should be of the same date so that all students are locating the same areas and pages when participating during the performance. Stress energy and materials conservation.
12. Protective Clothing a. Given firefighting protective clothing, inspect protective clothing. Protective clothing will be maintained according to locally established policy as required.	4 Day 9	Column 1 Reference: 12a, 12b STS Reference: 13a(3) Instructional Materials 3ABR57130-1-SG-112, Protective Clothing 3ABR57130-1-WB-112, Protective Clothing AFR 92-1

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PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION HOURS 2	SUPPORT MATERIALS AND GUIDANCE 3
b. Given firefighting protective clothing, don protective clothing within two minutes.		**Training Equipment** Complete set of special protective clothing (10) Structural Helmet (10) Example set of worn/damaged protective clothing (10) **Training Methods** Discussion/Demonstration (1 hr) Performance (3 hrs) **Instructional Environment/Design** Classroom (.5 hr) Laboratory (3.5 hrs) **Instructional Guidance** Stress that two minutes is allowed for donning of protective clothing in the training situation, but that an operational fire station requires a much quicker reaction time. Inform the students that they will receive more training in this area in order to increase their proficiency to meet operational demands. Stress energy and materials conservation.
13. Measurement Test and Test Critique	2 Day 9	
a. Measurement Test	(1.5)	
b. Test Critique	(.5)	

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PLAN OF INSTRUCTION	COURSE TITLE Fire Protection Specialist

BLOCK TITLE

Breathing Apparatus, Rescue Carries and Emergency First Aid

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
1. Block II, Orientation a. Block Content b. Safety c. Energy Conservation	.5 Day 10	Column 1 Reference 1a, 1b, 1c STS Reference None Instructional Materials 3ABR57130-1-SG-201, Block II, Orientation Training Methods Discussion/Demonstration (.5 hr) Instructional Environment/Design Classroom (.5 hr) Instructional Guidance Reemphasize policies and procedures as required from the course orientation. Place additional emphasis on energy and materials conservation. Assure that students are motivated in continuing the training for their new career.
2. Breathing Apparatus a. Given a self-contained breathing apparatus, don and operate apparatus in accordance with technical order data. b. Given a self-contained breathing apparatus, inspect and service apparatus in accordance with technical order data.	5.5 Day 10	Column 1 Reference 2a, 2b STS Reference 12e Instructional Materials 3ABR57130-1-SG-202, Breathing Apparatus TO 14S5-7-1, Self-Contained Breathing Apparatus Audio Visual Aids Charts Film: TVL 57-26, "Scott Air Pak" Training Equipment Breathing Apparatus (5) High Pressure Air Compressor (10)

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PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
		Training Methods Discussion/Demonstration (1.5 hrs) Performance (4 hrs) Instructional Environment/Design Classroom (1 hr) Laboratory (4.5 hrs) Instructional Guidance Use extreme caution when operating the breathing apparatus. Make sure the breathing apparatus fits properly. Stress safety as applicable while operating the air compressor. Stress energy and materials conservation.
3. **Rescue Carries** a. Given a victim identified as requiring emergency rescue and/or short distance transfer, perform rescue carries. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and IFSTA 109 Manual. All procedures must be strictly adhered to.	4 Day 11	Column 1 Reference 3a — STS Reference 12b Instructional Materials 3ABR57130-1-SG-203, Rescue Carries The American National Red Cross First Aid Manual IFSTA #109, Fire Service First Aid Practices Audio Visual Aids Transparencies Set #203, Rescue Carries Training Equipment 12' X 14' Salvage Cover (10) Straight Back Chair (Industrial Type) (10) Stretcher (10) Pike Pole (5) Bunker Coats (5) Training Methods Discussion/Demonstration (2 hrs) Performance (2 hrs)

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PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
		Instructional Environment/Design Classroom (1 hr) Laboratory (3 hrs) **Instructional Guidance** Stress safety, proper handling of simulated injured personnel to prevent further injury and the need for use of equipment and clothing provided. Students will be used throughout the first aid also as simulated victims. Stress energy and materials conservation.
4. Introduction to First Aid a. Given a victim identified as having been in an accident, demonstrate procedures for checking victims for injuries. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and IFSTA 109 Manual. All procedures must be accomplished with minimum instructor assistance.	1 Day 11	**Column 1 Reference** **STS Reference** 4a 12j **Instructional Materials** 3ABR57130-1-SG-204, Introduction to First Aid American National Red Cross First Aid Manual IFSTA #109 **Audio Visual Aids** Transparencies, Set #204, Introduction to First Aid **Training Equipment** Casualty Kit (10) First Aid Equipment (10) **Training Methods** Discussion/Demonstration (.5 hr) Performance (.5 hr) **Instructional Environment/Design** Classroom (.5 hr) Laboratory (.5 hr)

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PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
		Instructional Guidance Stress the importance of knowing how to administer emergency first aid. Allow students to identify simulated victims requiring first aid treatment. Use the casualty kit to simulate victims. Stress energy and materials conservation.
5. Identification and Treatment of Shock a. Given a victim identified as being in shock, demonstrate procedures to prevent or reduce shock. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and IFSTA 109 Manual. All procedures must be accomplished with minimum instructor assistance.	1 Day 11	**Column 1 Reference** 5a — **STS Reference** 12j **Instructional Materials** 3ABR57130-1-SG-205, Identification and Treatment of Shock American National Red Cross First Aid Manual IFSTA #109 **Audio Visual Aids** Transparencies, Set #205, Identification and Treatment of Shock **Training Equipment** Casualty Kit (10) First Aid Equipment (10) **Training Methods** Discussion/Demonstration (.5 hr) Performance (.5 hr) **Instructional Environment/Design** Classroom (.5 hr) Laboratory (.5 hr) **Instructional Guidance** Use the casualty kit to assist in simulating a victim requiring the need for treatment of shock. Use the emergency first aid equipment as required. Stress energy and materials conservation.

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PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
6. Swallowed Objects and Choking a. Without reference, identify procedures for administering emergency first aid treatment for swallowed objects and choking. Eighty percent of the procedures must be identified correctly.	1 Day 12	Column 1 Reference: 6a STS Reference: 12j Instructional Materials 3ABR57130-1-SG-206, Swallowed Objects and Choking American National Red Cross First Aid Manual Audio Visual Aids Transparencies, Set #206, Swallowed Objects and Choking Training Methods Discussion/Demonstration (1 hr) Instructional Environment/Design Classroom (1 hr) Instructional Guidance Stress the importance of being able to identify a victim suffering from swallowed objects and choking and the treatment required. Stress energy and materials conservation.
7. Poisoning and Drugs a. Without reference, identify procedures for administering emergency first aid for poisoning. Eighty percent of the procedures must be identified correctly. b. Without reference, identify procedures for emergency first aid treatment for drugs. Eighty percent of the procedures must be identified correctly.	1 Day 12	Column 1 Reference: 7a, 7b STS Reference: 12j Instructional Materials 3ABR57130-1-SG-207, Poisoning and Drugs American National Red Cross First Aid Manual American Druggist Counterdoses for the Home Audio Visual Aids Transparencies, Set #207, Poisoning and Drugs Training Methods Discussion/Demonstration (1 hr)

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PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	DURATION HOURS 2	3 SUPPORT MATERIALS AND GUIDANCE
		Instructional Environment/Design Classroom (1 hr) **Instructional Guidance** Stress the importance of identifying correctly either drug overdosage or poisoning of a victim. Stress the importance of proper treatment of the victim to preclude further complications. Stress energy and materials conservation.
8. Identification and Treatment of Wounds a. Given a victim, identified as having a wound, demonstrate procedures for the prevention of contamination and the control of bleeding. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and the IFSTA 109 Manual. All procedures must be accomplished with minimum instructor assistance.	2 Day 12	**Column 1 Reference** 8a — **STS Reference** 12j **Instructional Materials** 3ABR57130-1-SG-208, Identification and Treatment of Wounds American National Red Cross First Aid Manual IFSTA #109 **Audio Visual Aids** Transparencies, Set #208, Identification and Treatment of Wounds **Training Equipment** Casualty Kit (10) First Aid Equipment (10) **Training Methods** Discussion/Demonstration (1 hr) Performance (1 hr) **Instructional Environment/Design** Classroom (.5 hr) Laboratory (1.5 hrs) **Instructional Guidance** Stress identification and treatment of different types of wounds. Use the casualty kit and first aid equipment as required. Stress energy and materials conservation.

PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
9. Identification and Treatment of Specific Injuries a. Without reference, identify procedures for administering emergency first aid for burns. Eighty percent of the procedures must be identified correctly. b. Without reference, identify procedures for administering emergency first aid for frostbite and cold exposure. Eighty percent of the procedures must be identified correctly. c. Without reference, identify procedures for administering emergency first aid treatment for heat stroke, heat cramps and heat exhaustion. Eighty percent of the procedures must be identified correctly.	2 Day 12	**Column 1 Reference** 9a, 9b, 9c — **STS Reference** 12j **Instructional Materials** 3ABR57130-1-SG-209, Identification and Treatment of Specific Injuries American National Red Cross First Aid Manual **Audio Visual Aids** Transparencies, Set #209, Identification and Treatment of Specific Injuries **Training Equipment** Casualty Kit (10) First Aid Equipment (10) **Training Methods** Discussion/Demonstration (1 hr) Performance (1 hr) **Instructional Environment/Design** Classroom (.5 hr) Laboratory (1.5 hrs) **Instructional Guidance** Stress identification and treatment of the three classes of burns, injuries from cold or heat exposure. Use the casualty kit and first aid equipment as required. Stress energy and materials conservation.
10. Dressing, Bandaging and Splinting a. Given a victim identified as needing a dressing or bandage, demonstrate procedures for applying a dressing or bandage. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual. All procedures must be accomplished with minimum instructor assistance.	6 Day 13	**Column 1 Reference** 10a, 10b, 10c — **STS Reference** 12j **Instructional Materials** 3ABR57130-1-SG-210, Dressing, Bandaging and Splinting American National Red Cross First Aid Manual IFSTA #109

PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
b. Given a victim identified as needing a tourniquet, demonstrate procedures for applying a tourniquet. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and the IFSTA 109 Manual. All procedures must be accomplished with minimum instructor assistance. c. Given first aid equipment, and a victim identified as having a fracture, demonstrate procedures for administering first aid for fractures. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and IFSTA Manual 109 with minimum instructor assistance.		Audio Visual Aids Transparencies, Set #210, Dressing, Bandaging and Splinting Training Equipment Casualty Kit (10) First Aid Equipment (10) Training Methods Discussion/Demonstration (3 hrs) Performance (3 hrs) Instructional Environment/Design Classroom (2 hrs) Laboratory (4 hrs) Instructional Guidance Stress the importance of using correct methods in dressing or bandaging a wound. Stress that first aid consists of just splinting the fracture in place until a doctor can set the fracture. Use the casualty kit and first aid equipment as required. Stress energy and materials conservation.
11. Sudden Illness a. Without reference, identify procedures for administering emergency first aid for sudden illnesses. Eighty percent of the procedures must be identified correctly.	1 Day 14	Column 1 Reference: 11a STS Reference: 12j Instructional Materials 3ABR57130-1-SG-211, Sudden Illness American National Red Cross First Aid Manual Audio Visual Aids Transparencies, Set #211, Sudden Illness Training Methods Discussion/Demonstration (1 hr)

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PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
		Instructional Environment/Design Classroom (1 hr) **Instructional Guidance** Stress the importance of correct identification in cases of sudden illnesses and the importance of proper first aid procedures. Stress energy and materials conservation.
12. Respiratory Emergencies and Artificial Respiration a. Given a resuscitation manikin, demonstrate procedures for administering artificial respiration. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and IFSTA 109 Manual. All procedures must be accomplished with minimum instructor assistance. b. Given a resuscitation manikin, WB and resuscitation device, demonstrate inhalation procedures. Procedures utilized must be in accordance with the WB checklist. All procedures must be strictly adhered to, with help from the instructor on difficult areas. c. Given a resuscitation manikin, WB and resuscitation device, demonstrate aspiration procedures. Procedures utilized must be in accordance with the WB checklist. All procedures must be accomplished with minimum instructor assistance.	5 Day 14	**Column 1 Reference** 12a, 12b, 12c **STS Reference** 12j **Instructional Materials** 3ABR57130-1-SG-212, Respiratory Emergencies and Artificial Respiration 3ABR57130-1-WB-212, Respiratory Emergencies and Artificial Respiration American National Red Cross First Aid Manual IFSTA #109 **Audio Visual Aids** Films: TF 6296, "Mouth-to-Mouth Resuscitation" TF 6555, "Save that Life" Transparencies, Set #212, Respiratory Emergencies and Artificial Respiration **Training Equipment** Resuscitation Manikins (5) Resuscitation Devices (5) Aspirators (5) Airways (5) **Training Methods** Discussion/Demonstration (1.5 hrs) Performance (3.5 hrs)

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PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	2 DURATION HOURS	3 SUPPORT MATERIALS AND GUIDANCE
		Instructional Environment/Design Classroom (1 hr) Laboratory (4 hrs) Instructional Guidance Stress correct first aid procedures for the treatment of respiratory arrest. Stress energy and materials conservation.
13. Cardiopulmonary Resuscitation a. Given a resuscitation manikin, demonstrate procedures for administering cardiopulmonary resuscitation. Procedures must be in accordance with the American Heart Association requiring assistance from the instructor on the difficult parts.	4 Day 15	Column 1 Reference 13a — STS Reference 12j Instructional Materials → 3ABR57130-1-SG-213, Cardiopulmonary Resuscitation American Heart Association Pamphlet Audio Visual Aids Transparencies, Set #213, Cardiopulmonary Resuscitation Training Equipment Resuscitation Manikins (5) Training Methods Discussion/Demonstration (1 hr) Performance (3 hrs) Instructional Environment/Design Classroom (.5 hr) Laboratory (3.5 hrs) Instructional Guidance Stress the correct first aid procedures for the treatment of cardiac arrest. Stress energy and materials conservation.

PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION HOURS 2	SUPPORT MATERIALS AND GUIDANCE 3
14. Measurement Test and Test Critique	2 Day 15	
a. Measurement Test	(1.5)	
b. Test Critique	(.5)	

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PLAN OF INSTRUCTION	COURSE TITLE Fire Protection Specialist

BLOCK TITLE

Structural Firefighting Equipment and Accessories

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION HOURS 2	SUPPORT MATERIALS AND GUIDANCE 3
1. Blocks III and IV, Orientation a. Block Content b. Safety c. Energy Conservation	.5 Day 16	**Column 1 Reference** 1a, 1b, 1c · **STS Reference** None **Instructional Materials** 3ABR57130-1-SG-301, Blocks III and IV, Orientation **Training Methods** Discussion/Demonstration (.5 hr) **Instructional Environment/Design** Classroom (.5 hr) **Instructional Guidance** Stress danger of moving equipment, leaning in chairs, improper acts and failure to work as a team while in fire protection training. Conservation of training materials, use of gasoline-operated power trucks, better care of protective clothing, minimum rpm when operating vehicles, overflowing trucks with water, better conservation of cleaning materials, tires and tire pressures, leaking trucks, expanding gasoline in trucks, better inspection, and operator maintenance; stressed throughout Blocks III and IV. Assure that students do not operate hangar doors. Stress the importance of properly operating Air Force equipment in order to prevent damage resulting in costly repairs.
2. Operations, Maintenance and Mounted Equipment on the P-10 Rescue Vehicle a. Given the appropriate inspection checklist and technical data, inspect and perform operator maintenance on the P-10 rescue vehicle and mounted equipment. All appropriate items	5.5 Day 16	**Column 1 Reference** / **STS Reference** 2a — 3b(3), 13a(1) 2b — 12d 2c — 3b(2), 3b(3), 13b, 13c

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PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
on the inspection checklist must be inspected. Operator maintenance must be accomplished according to the technical order. b. Given a P-10 rescue vehicle and mounted equipment, demonstrate the use of, and reinstall tools and operate equipment in accordance with appropriate technical data, while observing all applicable safety procedures. c. Given necessary equipment, perform preventive maintenance on the P-10 rescue vehicle and mounted equipment IAW AFTO Form 433. Maintain station facilities as required.		**Instructional Materials** 3ABR57130-1-SG-302, Operations, Maintenance and Mounted Equipment on the P-10 Rescue Vehicle 3ABR57130-1-WB-302, Operations, Maintenance and Mounted Equipment on the P-10 Rescue Vehicle TO 36A12-12-13-1, Firefighting Truck, Forcible Entry **Training Equipment** Vehicle: A/S32P-10, Rescue Vehicle and Mounted Equipment (10) Helmet (1) Gloves (1) **Training Methods** Discussion/Demonstration (1.5 hrs) Performance (4 hrs) **Instructional Environment/Design** Classroom (1 hr) Laboratory (4.5 hrs) **Instructional Guidance** Stress safety while working around the P-10 rescue vehicle. Insure that all students wear gloves when operating the winch and cable. Do not allow students to slide the cable through their hands, even though they are wearing gloves, walk the cable in. Stress the importance of properly operating Air Force equipment in order to prevent damage resulting in costly repairs. Stress energy and materials conservation.
3. Pre-Fire Plans a. Without reference, identify basic facts concerning preparation of prefire plans. Eighty percent of the basic facts must be identified correctly.	2 Day 17	**Column 1 Reference** 3a — **STS Reference** 14a(15) **Instructional Materials** 3ABR57130-1-SG-303, Pre-Fire Plans **Audio Visual Aids** Film: TF 6058, "Structural Fire Suppression" Charts

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PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES

4. Miscellaneous Rescue

a. Without reference, identify procedures for rescuing personnel from miscellaneous areas and disasters. Eighty percent of the procedures must be identified correctly.

b. Using a salvaged automobile, P-10 rescue vehicle and mounted equipment, perform normal and emergency entry into a vehicle IAW locally established procedures, while strictly adhering to all applicable safety procedures. Operate tools and equipment as required.

c. Using a salvaged automobile, rescue dummy, P-10 rescue vehicle and mounted equipment, perform rescue from a vehicle. Rescue must be in accordance with locally established procedures while observing all applicable safety practices. Operate tools and equipment as required.

2 DURATION (HOURS)

4
Day 17

3 SUPPORT MATERIALS AND GUIDANCE

Training Methods
Discussion/Demonstration (2 hrs)

Instructional Environment/Design
Classroom (2 hrs)

Instructional Guidance
Stress the importance that prefire planning "plays" in the Air Force and supporting the mission of fire protection. Stress energy and materials conservation.

Column 1 Reference	STS Reference
4a	12i(4)
4b	12d, 12f(3)
4c	12d, 12i(3)

Instructional Materials
3ABR57130-1-SG-304, Miscellaneous Rescue
3ABR57130-1-WB-304, Miscellaneous Rescue
TO 36A12-12-13-1

Audio Visual Aids
Film: CFL 032, "Collision Rescue"

Training Equipment
Vehicle: A/S32P-10, Rescue Vehicle and Mounted Equipment (10)
Rescue Dummy (10)
Salvaged Automobile (10)
Helmet (1)
Gloves (1)

Training Methods
Discussion/Demonstration (2 hrs)
Performance (2 hrs)

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PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE

Instructional Environment/Design
Classroom (1.5 hrs)
Laboratory (2.5 hrs)

Instructional Guidance
Insure that all students wear gloves while performing on the salvaged automobile and P-10 rescue vehicle. Do not allow students to cut or further disfigure the salvaged automobile. If sharp or jagged metal does result from making continuous entries into the simulated wrecked vehicle, correct these situations or report them to the instructor-supervisor as safety hazards. Even though the salvaged automobile has a purged gasoline tank, stress "no smoking" as an operational safety item, because many times on-lookers at an accident scene will unconsciously walk up with a lit cigarette or other types of smoking devices. hence, creating a very dangerous situation. Remind students not to smoke on the hangar floor. Assure that all equipment used for today's training is returned to the proper location. Stress energy and materials conservation.

5. Alarm Room Procedures and Operation

6
Day 18

a. Without reference, identify operational procedures of the alarm and communication center with 80 percent accuracy.

b. Given an alarm and communication center trainer, monitor, receive and record one normal and one emergency message. Proper communication procedures must be utilized in accordance with locally established policies and all messages must be correctly recorded in less than three minutes.

c. Given an alarm and communication center trainer and three messages, alert fire-fighting personnel and support agencies, dispatch

Column 1 Reference	STS Reference
5a	9a
5b	9g
5c	9b, 9c, 9d, 9e
5d	9f
5e	9h

Instructional Materials
3ABR57130-1-SG-305, Alarm Room Procedures and Operation
3ABR57130-1-WB-305, Alarm Room Procedures and Operation

Audio Visual Aids
Film: TVL 57-18, "Alarm Room Procedures"
Charts

Training Equipment
Trainer: Fire Department Communications Center, 4041 (5)

PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES

equipment, inform personnel of location and nature of emergencies and provide pertinent information on emergencies as required. Proper communication procedures must be utilized in accordance with locally established policies and all actions must be completed in less than two minutes.

d. Given an alarm and communication center trainer and two messages, maintain fire station logs. Information must be logged with minimum instructor assistance in accordance with locally established policies.

e. Given an alarm and communication center trainer, maps, charts, status boards and selected messages, read and maintain maps, charts and status boards in accordance with locally established policies. All tasks must be accomplished in less than five minutes.

6. Structural Firefighting Accessories

a. Using a 3/4" rope, tie four (4) types of knots and three (3) types of hitches. Knots and hitches will be tied in accordance with the WB procedures with minimum instructor assistance.

b. Given various types of fire protection handtools and equipment, use ropes to tie tools and equipment for hoisting. Knots will be tied in accordance with the WB procedures with minimum instructor assistance.

2 DURATION (HOURS)

8
(6/2)
Day 19

3 SUPPORT MATERIALS AND GUIDANCE

Training Methods
Discussion/Demonstration (2 hrs)
Performance (4 hrs)

Instructional Environment/Design
Classroom (1.5 hrs)
Laboratory (4.5 hrs)

Instructional Guidance
Stress importance of remaining calm and accurate in recording information. Never discuss classified information over communication system. Stress energy and materials conservation. Give the outside assignment for the next subject.

Column 1 Reference	STS Reference
6a, 6b	10n
6c	13a(2)
6d	101

Instructional Materials
3ABR57130-1-SG-306, Structural Firefighting Accessories
3ABR57130-1-WB-306, Structural Firefighting Accessories

Audio Visual Aids
Charts

Training Equipment
Structural Firefighting Vehicle and Mounted Equipment (5)
Length of Rope, 3/4-Inch Diameter (1)

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PLAN OF INSTRUCTION (Continued)

1 UNITS OF INSTRUCTION AND CRITERION OBJECTIVES	DURATION (HOURS) 2	3 SUPPORT MATERIALS AND GUIDANCE
c. Given common structural firefighting tools and equipment, inspect and perform operator maintenance on tools and equipment. Procedures listed in the WB must be followed with minimum instructor assistance. d. Given a structural firefighting vehicle, perform ladder operations to include: remove, carry, position, raise and climb ladders. All procedures in the WB must be strictly adhered to, while observing all applicable safety procedures.		2-1/2 Gallon Fire Extinguisher (5) Fire Hose, 2-1/2-Inch X 50 Feet (5) Roof Ladder (5) Extension Ladder (5) Axe (5) Pike Pole (5) 2-1/2-Inch Nozzle (5) Training Methods Discussion/Demonstration (3 hrs) Performance (3 hrs) Outside Assignments (2 hrs) Instructional Environment/Design Classroom (2.5 hrs) Laboratory (3.5 hrs) Instructional Guidance Check the outside assignment given the previous day. Stress importance of careful and precise movements when handling ladders, proper methods to prevent falling from ladders and proper climbing angles. Stress proper knot tying for safety and security of equipment and personnel. When climbing the extension ladder, do not allow students to remain on the elevated platform. Assure that the ladder is secured at the top prior to allowing students to climb. Stress energy and materials conservation. Give the outside assignment for the next subject.
7. Fire Protection Hydraulics a. Without the aid of references, identify principles of hydraulics as they apply to fire protection. Eighty percent of the principles must be identified correctly.	6 (4/2) Day 20	Column 1 Reference 7a STS Reference 10b Instructional Materials 3ABR57130-1-SG-307, Fire Protection Hydraulics 3ABR57130-1-PT-307, Fire Protection Hydraulics Audio Visual Aids Charts

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PLAN OF INSTRUCTION (Continued)

UNITS OF INSTRUCTION AND CRITERION OBJECTIVES 1	DURATION (HOURS) 2	SUPPORT MATERIALS AND GUIDANCE 3
		Training Methods Discussion/Demonstration (2 hrs) Performance (2 hrs) Outside Assignments (2 hrs) **Instructional Environment/Design** Classroom (1.5 hrs) Laboratory (2.5 hrs) **Instructional Guidance** Check the outside assignment given the previous day. Stress importance of hydraulics in fire service to provide proper and safe streams and to prevent damage to pump and associated equipment. Stress energy and materials conservation. Give the outside assignment for the next subject in Block IV.
8. Measurement Test and Test Critique	2 Day 20	
a. Measurement Test	(1.5)	
b. Test Critique	(.5)	

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FIRE PROTECTION OCCUPATIONAL SAFETY

INTRODUCTION

TIME: 5 min

Attention: Did you realize that approximately 80% of disabling injuries occur off-duty. About 83% of ground accidents involve military personnel. Air Force civilians account for about 14% with the remaining 3% non-Air Force persons.

Review: In mission and organization you learned of the mission, structure and major organizations of the Air Force and some of the efforts needed to accomplish the mission.

Overview: In this lesson we will talk about how accidents can be prevented by elimination of unsafe acts and unsafe conditions. We will also talk about how accidents can effect the Air Force mission and how AFR 127-101 can help in constructing an effective safety program. Finally, we will discuss who is responsible for safety in the Air Force.

Motivation: Each year, accidents cause hundreds of deaths and thousands of injuries to Air Force personnel. These fatalities and injuries, most of which could have been prevented, impose a tremendous direct cost on the Air Force. But, most important of all, the next accident that you may be involved in, regardless of how small, can take your life.

Transition: We will begin our lesson by discussing material in relation to industrial safety hazards.

BODY

TIME: 2 hrs 50 min

Presentation:

TIME: 2 hrs 40 min

1. Without reference, identify basic facts and principles relating to the objectives of industrial safety with 80 percent accuracy.

Energy and training material conservation and conserve cleaning materials.

Use AFR 92-1

a. Objective of industrial safety

(1) Prevent accidents

(a) Good housekeeping

(b) Safety centered programs

1. Wipe up spills

33

2. Safety meetings

b. Eliminate safety hazards

    (1) Inspect work area for hazards

    (2) Be safety conscious at all times

c. Probable causes of unsafe acts

    (1) Individuals inattentiveness, excitability, impatience and stubborness

    (2) Personal problems that cause undesirable attitudes and behavior

d. Probable causes of unsafe conditions

    (1) Irresponsibility and neglect of duty

    (2) Unsafe cleaning practices

        (a) Using wax on stall floors

        (b) Using POL products for cleaning

e. General Safety

    (1) Use common sense when doing a job

    (2) Think before taking on a task

        (a) Take your time

        (b) Ask when in doubt

    (3) Always report all unsafe acts and conditions to your immediate supervisor

f. AFR 127-101, Accident Prevention Handbook

    (1) Provides guidance for safety programs

        (a) Explains hazards and prescribes safety precautions

68

34

(b) Applies to all Air Force personnel and organizations

(2) Provides guidance for the operation of industrial type equipment

INTERIM SUMMARY

2. Without reference, identify safe and unsafe procedures involved in performing station duties with 80 percent accuracy.

35mm Slide, carousel set #104, Fire Protection Occupational Safety

a. Safety procedures

(1) Hose maintenance

(a) Do not exceed recommended test pressure or recommended number of sections

(b) Do not pressurize hose that is obviously worn or torn or may rupture under pressure

(c) Always use caution when hoisting hose sections in the hose tower.

(2) Extinguisher Maintenance

(a) Do not over pressurize extinguishers

(b) Follow technical order data when servicing extinguishers

(c) Properly ventilate the area when working with toxic agents

(d) Always wear protective equipment when working with agents

(3) Vehicle Inspection

(a) Be sure you have required air pressure before operating vehicle

(b) Insure warning (air) buzzer is connected

(c) Use caution when inspecting top of vehicle

(d) Do not enter engine compartment while engine is running

(e) Notify driver if you are working under vehicles. Have the wheels chocked.

INTERIM SUMMARY

3. Without reference, identify safe and unsafe procedures involved in the wearing of protective clothing with 80 percent accuracy.

a. Safety Procedures

b. Hood

(1) Insure reflective face piece is in place

c. Helmet

(1) Made strong to protect head

d. Coat

(1) Keep collar turned up for neck protection

(2) Do not use unless in good serviceable condition

(a) If coat is flaking, replace with serviceable one.

e. Trousers

(1) Always wear suspenders for better support

(a) Insure proper fit

(b) Replace if necessary

f. Boots

(1) Make sure they are not tight

(a) Keep inside dry and replace if necessary

g. Gloves

(1) Always wear serviceable gloves

(a) Leather with inserts

(b) Aluminized special gloves

INTERIM SUMMARY

4. Without reference, identify safe and unsafe procedures pertaining to mounting fire protection vehicles with 80 percent accuracy.

a. Safety procedures

b. Use all handles provided to insure safety

(1) Use safety straps on tail board of vehicle

(2) Use seat belts inside vehicle

c. Caution when riding tailboard

(1) Do not mount vehicle while in motion

(2) Do not dismount vehicle while in motion

d. Make sure all doors are secure on vehicle

e. Observe safety precautions while driving vehicles.

(1) Do not speed

(2) Always have a spotter when backing vehicle

INTERIM SUMMARY

5. Without reference, identify safe and unsafe procedures involved in fighting fires with 80 percent accuracy.

a. Safety procedures

b. Always wear protective clothing

c. Use lifeline

(1) Entering building

(2) Making openings in roof

d. Working on the roof

(1) Check for weak structure

e. Caution with tools

(1) Secure all tools on roof

(2) Proper procedures when using

f. Extinguishing agents — Film: TFI-8193, "Meet Mr. Noise"

(1) Use correct extinguishing agent

(2) Ventilate when working with toxic agents

(3) Use protective equipment when working with agents

Application: TIME: N/A

Evaluation: TIME: 10 min

Intersperse throughout the presentation

CONCLUSION

TIME: 5 min

Summary: In today's lesson you have learned how accidents can be prevented by the elimination of unsafe acts and unsafe conditions. We also talked about how accidents can effect the mission of the Air Force. Finally, we learned about AFR 127-101, and how it can help you in constructing an effective safety program.

Remotivation: No one likes to be involved in an accident. The Air Force does not want you to be involved in one because of the physical pain, time wasted, money and primarily because accidents impair the mission. We should strive to prevent accidents.

Assignment: N/A continue with the next subject, Extinguishing Agents

Closure: Remember, only you can prevent the loss of life and property through the elimination of accidents. "THINK SAFETY."

EXTINGUISHING AGENTS

INTRODUCTION

TIME: 5 min

Attention: What would happen if you attempted to use water as an extinguishing agent on an electrical fire? A quite obvious example of what should not be done; however, the Air Force does have on record incidents of this same type. Some years ago at one of our bases, a fire occured in the kitchen of an NCO club. The material involved was grease and other class B items on a stove. The man that discovered the fire attempted to extinguish it with a pan of water. This action only helped to accelerate and spread the fire to other areas. (Behind the stove and throughout the exhaust ducts). The end result was that by the time the fire department arrived, the fire was completely out of control and the building a complete loss.

Review: In our previous lesson, we learned that safety and good safety practices will help us to perform our jobs better. So apply what you have learned about safety to all future lessons.

Overview: During this class, we will discuss the agents used commonly by the USAF, extinguishing terms, the advantages and limitations of each agent.

Motivation: In order to fulfill our fire protection mission and to prevent incidents such as the one listed above, we must know each agent and how it may effectively be used.

Transition: Let us begin our lesson by discussing suppression, control and extinguishment.

BODY

TIME: 2 hrs 50 min

Presentation:

TIME: 2 hrs 40 min

1. Without reference, identify principles relating to suppression, control and extinguishment of fires. Eighty percent of the principles must be identified correctly.

Use: AFR 92-1
Use Charts # CC75-83, CC75-84 "Extinguishing Agents"

a. Explanation of terms

(1) Cooling - Reduce temperature or remove heat faster than it can be generated.

(2) Smothering - Removing oxygen from the fire

(3) Control - Stopping the spread

(4) Suppression - Action which you take to remove the heat, fuel, or oxygen

EXTINGUISHING AGENTS

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(3) Control - Stopping the spread

(4) Suppression - Action which you take to remove the heat, fuel, or oxygen

(5) Extinguishment - Final product; the heat, fuel or oxygen has been removed, another fire is out.

b. Agents

(1) Water

(a) Class of fire "A"

(b) Method of extinguishment

1. Cooling

2. Smothering

(2) Wet Water

(a) Detergents added for more penetration

(3) Foam

(a) Mechanical

1. Protein based

2. Used in aerospace vehicles

(b) Aqueous Film Forming Foam

1. Light water

2. Used in vehicles

(c) Chemical

1. Sodium Bicarbonate and Aluminum Sulfate

2. Used in fire extinguishers

(d) All types of foam used for class "B" fires

(e) Method of extinguishing is smothering

INTERIM SUMMARY

(4) Carbon Dioxide CO2

- (a) Class of fire "B" and "C"
- (b) Method of extinguishment - smothering
- (c) Non Conductor of electricity
- (d) Used in fire extinguishers as first aid equipment (high pressure)
- (e) Safety
  - 1. Use caution in confined area
  - 2. Wear gloves
  - 3. Handle with caution due to high pressure
- (f) Advantage
  - 1. Does not corrode or damage equipment

(5) Dry Chemical - Finely ground bicarbonate of soda

- (a) Class of fire B and C
- (b) Method of extinguishment - smothering
- (c) Non conductor of electricity
- (d) When properly used, small amount can extinguish large fires

(6) Dry Powders

- (a) Class of fire "D"
- (b) Method of extinguishment - smothering
- (c) Class "D" fires are not usually involved with or around electrical equipment; therefore, the conductivity of these agents are irrelevent

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(d) Type of dry powder

1. Pyrene G-1-grainy graphite

2. Lith-X - finely ground graphite

3. Met-L-X - sodium chlorate based agent

INTERIM SUMMARY

2. Without reference, identify the characteristics of extinguishing agents by matching proper agents to classes of fires and associated hazards with 80 percent accuracy.

Use Trainer S/N02, Electrical Conductivity
Laboratory Equipment
Samples of Extinguishing Agents

a. Agents

(1) Water

(a) Hazard

1. Conductor of electricity

(2) Wet Water

(a) Hazard

1. Conductor of electricity

(3) Foam

(a) Hazards

1. Mechanical

2. Aqueous film forming foam

3. Chemical

4. All three types are conductors of electricity

(4) Carbon Dioxide CO2

(a) Hazards

1. Displaces Oxygen

Stress Safety

2. Frost bite

3. High pressure

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(5) Dry Chemical

  (a) Hazards

    1. None

(6) Dry Powder

  (a) Hazards

    1. Pyrene G-1 and Lith-X are conductors of electricity

INTERIM SUMMARY

Application: TIME: N/A

Evaluation: Intersperse throughout the lesson TIME: 10 min

CONCLUSION TIME: 5 min

Summary: This class has covered the different types of extinguishing agents most commonly used by the USAF. We have discussed water, foam, CO2, dry chemical and dry powder. The effects each agent has on a fire, the hazards and advantages and limitations of each.

Remotivation: With a thorough knowledge of these agents, you are now on the way to more effectively performing your mission as an Air Force fire protection specialist.

Assignment: Read and study SG-106, Principles and Theory of Combustion and answer the questions at the end of the unit.

Closure: This completes the lesson for today.

PRINCIPLES AND THEORY OF COMBUSTION

INTRODUCTION

TIME: 5 min

Attention: The history of fire began with the first stage of man - Tell of help and destruction, man's fear of fire - why. Great disasters resulting from fire. Some instances personal and case records, Chicago, Boston, etc.

Review: Yesterday we discussed extinguishing agents, their principles relating to suppression, control and extinguishment of fires.

Overview: In today's lesson we will discuss what is necessary to have fire, terms commonly used in the study of fire, how fires are classified and how fire spreads.

Motivation: When we have a knowledge of fire, that knowledge will replace the fear we may have. So knowledge is necessary if we are to become good fire protection specialists.

Transition: Today we will begin our lesson by discussing the chemistry and physics of combustion.

BODY

TIME: 5 hrs 50 min

Presentation:

TIME: 4 hrs 45 min

1. Without reference, identify principles relating to chemistry and physics of combustion. Eighty percent of the principles must be identified correctly.

Show Film: CFL 6, "Science of Fire"
Use: AFR 92-1

   a. Define Fire (combustion)

      (1) A rapid oxidation with evoluation of light and heat.

   b. Explain relationship of components of fire

      (1) Fuel as related to fire triangle

      (2) Oxygen as related to fire triangle

      (3) Heat as related to fire triangle

Energy and training material conservation and conserve cleaning materials

c. Define Fuel

   (1) Any substance used to produce heat or power by combustion

d. Define Oxygen

   (1) An element that is colorless, odorless and tasteless gas, forming approximately 21% of the air we breathe

e. Define Oxidation

   (1) The union of a substance with oxygen

f. State the classes of oxidation

   (1) Slow

   (2) Rapid

   (3) Ultra-Rapid

g. Define Oxidizing Agents

   (1) Materials that when heated will yield oxygen

h. Explain effects of oxidizing agents

   (1) Increased intensity or burning rate of a fuel

i. Define Intensity

   (1) Intensity - force or energy of a physical agent (governed by vapors and air)

j. Define Heat

   (1) A condition that causes the temperature of a substance to rise

k. State the heat energy sources

   (1) Mechanical

   (2) Chemical

   (3) Electrical

   (4) Compression

(5) Solar

(6) Atomic

l. Explain methods of heat transfer

Use Chart #67-63 ,"Heat Transmission"

(1) Conduction

(a) Transfer of heat from one body to another by direct contact

(2) Convection

(a) Transmission of heat by moving currents

(3) Radiation

(a) Transmission of heat through heat rays

INTERIM SUMMARY

m. Explain common fuel elements and their relationship to products of combustion

(1) Common fuel elements

(a) Carbon

(b) Hydrogen

(c) Sulphur

(2) Products of Combustion

(a) H2o - water vapor

(b) SO2 - Sulphur dioxide

(c) CO - Carbon monoxide

(d) CO2 - Carbon dioxide

n. Explain relationship of basic facts and state general principles about suppression, control and extinguishment

(1) Suppression- any action that affects the fire by controlling or eliminating the various elements that support combustion

(2) Control - to prevent the spreading of a fire or place it in check so that propagation will not take place.

(3) Propagation - spread of fire

(4) Extinguishment - the result of stopping the process of rapid oxidation by the removal of either heat, fuel or oxygen

INTERIM SUMMARY

2. Without reference, identify characteristics and hazards of flammable materials with 80 percent accuracy.

a. Explain characteristics of fuel

(1) Fuel may be solid, liquid or gas

(2) Most fuels must be in a vapor state to burn

(3) Volatile - the ability to easily pass away by evaporating

(4) Magnitude - size or greatness of area involved (dependent on surface area exposed to air)

b. State classes and types of fire

(1) Class "A" solids

(2) Class "B" liquids and gasses

(3) Class "C" electrical

(4) Class "D" metals

c. Define flashpoint, fire point and ignition temperature of a fuel

(1) Flashpoint - the lowest temperature at which fuel gives off enough vapors so that when ignited will flash across the surface and go out

Use: Trainers:
Fire Triangle, 3168
Combustible Hazard Kit, 004
Vapor Trough, 3163
Desk, Laboratory, 8250
Oxygen and Bottle
Various Laboratory Test Items
Gloves
Flammable Materials
Butane and Bottle

2 INSTRUCTORS ARE REQUIRED
for 1 hour of demonstration

Chart 68-43 ,"Flash Point"

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(2) Fire Point - the lowest temperature at which vapors are given off fast enough so that when ignited will continue to burn

Chart 68-44, "Fire Point"

(3) Ignition Temperature of a substance is that temperature required to initiate or cause self sustained combustion

Chart 68-45, "Ignition Temperature"

d. Define spontaneous heating

(1) The combining of a substance with oxygen producing heat

e. Define spontaneous ignition

(1) The combining of a substance and oxygen producing enough heat to cause the substance to ignite

f. Define explosive limits

Use Chart 69-169, "Explosive Limits"

(1) The mixture of air with fuel vapors forms the explosive limits, it will either burn or explode when ignited.

g. Define lower explosive limits

(1) The minimum amount of fuel vapors mixed with air that will burn or explode when ignited

h. Define upper explosive limits

(1) The maximum amount of fuel vapors mixed with air that will explode or burn when ignited

i. Define explosive range

(1) The mixture of fuel vapors between the upper and lower explosive limits, is called the explosive range

Show Film TFI #5277B, "Fire Prevention, Know Your Hazards"

Use Laboratory

TIME: 1 hr

2 INSTRUCTORS ARE REQUIRED

Application:

Interspersed throughout the lesson

Evaluation:

TIME: 5 min

Interspersed throughout the lesson

CONCLUSION TIME: 5 min

ummary: We have discussed the principles relating to chemistry and physics of combus-ion, also identified characteristics and hazards of flammable materials.

emotivation: Fire prevention is one of the most important parts of your fire protec-ion mission. With the information from this lesson you have acquired the basics of ow fires may start. You should now be prepared to help in the elimination of fires as ou enter the fire protection career field.

Assignment: Read and study the following SG Units and answer the questions at the end of each unit:

1. SG-107, Natural Cover Fires
2. SG-108, Miscellaneous Firefighting

Closure: What you have learned throughout this lesson will apply to our next lesson.

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NATURAL COVER FIRES

INTRODUCTION TIME: 5 min

Attention: Some areas where you may be stationed, natural cover fires are common. You could be required to take a crew to help fight one of these dangerous fires. These men are going to look to you for their safety. Will you know what to do in combating natural cover fires?

Review: Yesterday we discussed principles and theory of combustion and you saw some demonstrations in the lab.

Overview: During the next three hours, we will discuss the principles of natural cover fires to include characteristics of natural cover fires, effects of nature, types of natural cover fires, terms pioneer tools and proper use of each type. Special equipment, also heavy equipment, used in fighting natural cover fires.

Transition: Now we will begin our lesson on natural cover fires.

BODY TIME: 2 hrs 50 min

Presentation: TIME: 2 hrs 45 min

1. Without reference, identify principles involved in natural cover firefighting. Eighty percent of the principles must be identified correctly.

Use: AFR 92-1

   a. Running fire - Fire moves with the wind, the rate of burning depends on velocity of wind, the type and abundance of fuel and contour of the land

   b. Fire Break - Cleared areas (natural and manmade)

   c. Natural Barriers - Nature made to halt a NC fire that burns up to them.

   d. Artificial Barriers - Manmade barriers used to impede fire progress

   e. Back Firing - Employed to burn back toward advancing head, creating fast fire break

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f. Extinguishing Agent

(1) Most common is earth

(2) Secondary is water

Energy and training material conservation

g. Parts of a natural cover fire:

(1) Fire Head - the point where the fire is progressing the fastest. A NCF may have several heads, depending on the ;type, abundance and location of fuel. Fire heads generally travel with the wind

Use Chart #________________
"Natural Cover Fire"

(2) Fire Tail - the upwind portion of the fire. This is the point where the progress of the fire is usually near the origin

(3) Fire Flank - all portions of the fire line between the head and tail are called the flanks

(4) Fire Area - the burnt area within the perimeter of the heat, tail and flanks of the fire

h. Types of natural cover fires

(1) Ground fires - this type of fire travels at ground level or below

(2) Surface fire - this type travels rapidly if the wind is high and when fuel is dry, above ground

(3) Crown Fire - Travels in the tops of trees and in high brush. This type is the most dreaded.

(4) Spot fire - fires start in advance of the heads by wind blown sparks or burning material

INTERIM SUMMARY

2. Without reference, identify the principles involved in various methods of controlling and extinguishing natural cover fires. Eighty percent of the principles must be identified correctly.

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a. Describe direct, indirect, one lick and sectional methods used for control and extinguishment of natural cover fires

(1) Direct method

Use Chart 68-232 "Terms of Natural Cover Fires"

    (a) Approach along the flanks

    (b) Extinguish flanks to turn fire into wind

    (c) Used on moderately hot fire

(2) Indirect Method

    (a) Use fire breaks or barriers

        1. Natural

        2. Manmade

    (b) Used on a hot running fire

(3) Sectional method

    (a) Unit of men are placed in a specific section of the fire line and have full responsibility for all firefighting efforts in that section

    (b) Best used against a slow moving natural cover fire

(4) One lick method

    (a) Hand tools and or equipment used to make a fire break

    (b) Used to knock down hottest part of fire

INTERIM SUMMARY

3. Without reference, identify principles relating to the tools and equipment used in natural cover firefighting. Eighty percent of the principles must be identified correctly.

a. Chopping tools

Show Film TVL 57-20, "Fire-fighting Hand Tools"

(1) Double bit axe

(2) Single bit axe

(3) Pulaski tool

(4) Brush hook

(5) Scythes

b. Scraping tools

(1) Fire Rake

(2) Mcleon tools

(3) Leaf or broom rake

c. Digging tools

(1) Long handle round point shovel

(2) Mattock

(3) Can't hook

Describe special equipment and procedures for using each item to include

(1) Back pump

(2) Portable pumps

(3) Hose

(4) Saws

(a) Power chain saws

(b) Felling saws

(c) Bucking saws

e. Describe and explain control and extinguishment of natural cover fires to include mechanized and heavy equipment

(1) Plows

(2) Tractors

(3) Graders

(4) Trenchers

Use Charts:
65-610, "530-B Pumper Truck, (Right Side)"
65-611, "530-B Pumper Truck, (Left Side)"

(5) Bulldozers

(6) Aircraft

f. Explain the use of the 530B firefighting vehicles in combating natural cover fires

Application: TIME: N/A

Evaluation: TIME: 5 min

Interspersed throughout lesson

CONCLUSION TIME: 5 min

Summary: Today we discussed the principles of natural cover firefighting, methods of controlling and extinguishing, also tools and equipment.

Remotivation: Each year, natural cover fires do millions of dollars worth of damage to our nation and cause the deaths of hundreds and sometimes thousands of people. By using the knowledge you have gained from this lesson, hopefully you will someday play a major part in helping to reduce this loss to our nation.

Assignment: N/A Continue with Miscellaneous Firefighting

Closure: This ends our lesson on natural cover fires. Next we will cover miscellaneous fires because these two are related.

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MISCELLANEOUS FIREFIGHTING

INTRODUCTION TIME: 5 min

Attention: Miscellaneous fires are fires of various types that cannot be pre-fire planned. This makes it more difficult for fire suppression personnel because no set plans are available. The cause and types of these fires are not known sometimes, until arrival at the scene. Upon arrival, it takes quick decisions and alertness on the firefighters part to safely attack and extinguish these fires.

Review: Recover and tie in main points on natural cover firefighting that apply to miscellaneous firefighting.

Overview: During this class on miscellaneous fires, we will discuss the principles involved with miscellaneous fires, the methods of controlling and extinguishing them and tools recommended for them.

Motivation: This class is important to fire protection personnel because it could possibly save someone's life and could reduce a large amount of property damage.

Transition: During the next three hours, we will discuss the various types of miscellaneous fires, their hazards, and recommended extinguishing agents.

BODY TIME: 2 hrs 50 min

Presentation: TIME: 2 hrs 45 min

1. Without reference, identify principles involved in miscellaneous firefighting. Eighty percent of the principles must be identified correctly.

Energy and material conservation

a. Miscellaneous fires are fires of various types which are seldom encountered in the fire protection field. Fires of this nature are unpredictable and cannot be pre-fire planned.

Use: AFR 92-1

(1) Types of miscellaneous fires

(a) Sanitary land fill fires

(b) Dumpster fires

(c) Vehile fires

(d) Electrical fires

1. Motors/generators

2. Transformers

(e) Agricultural type fires

1. Grain storage

2. Hay storage

(2) Hazards - vary depending on the class and nature of fire

b. The extinguishing agents recommended on miscellaneous fires will also vary depending upon the class of fire and materials burning

c. Firefighting procedures used on miscellaneous fires are up to the senior fire official present

INTERIM SUMMARY

2. Without reference, identify the principles involved in various methods of controlling and extinguishing miscellaneous fires. Eighty percent of the principles must be identified correctly.

Use 35mm Slides, Carousel Set #108

a. Sanitary land fill fires

(1) Municipal dumps

(a) Disposal of class "A" combustible materials

(b) Controlled burning allowed under ideal situations

(2) Landfill areas

(a) Used for land fill purposes only

(b) Disposal of class "A" materials

(c) No burning allowed

(d) Most satisfactory disposal method

1. No burning

2. No air pollution

- (3) Methods of control and extinguishment
    - (a) Use of fire breaks
    - (b) Extinguishing agents
        - 1. Water or water fog most common
        - 2. earth secondary

b. Dumpster fires

- (1) Dumpsters are located in access areas around buildings
- (2) Limited temporary storage of class "A" materials
- (3) No burning allowed
- (4) Method of control and extinguishment
    - (a) Water or water fog

c. Vehicle fires

- (1) Most vehicle fires originate in the electrical or fuel systems
- (2) Hazards
    - (a) Electrical - shock
    - (b) Explosion
- (3) Method of control and extinguishment
    - (a) Electrical components
        - 1. CO2
        - 2. Dry chemical
    - (b) Fuel components
        - 1. CO2
        - 2. Foam
        - 3. Dry chemical

d. Electrical Fires

   (1) Motors/generators

   (2) Transformers

   (3) Hazards

      (a) Shock

      (b) Explosive

   (4) Methods of control and extinguishment

      (a) Use a non-conductive extinguishing agent

         1. CO2

         2. Dry chemical

e. Agricultural type fires

   (1) Explosive hazard may be present

   (2) Methods of control and extinguishment

      (a) Use fire breaks and barriers

      (b) Use direct or indirect method of attack

      (c) Extinguishing agents

         1. Water

         2. Earth

INTERIM SUMMARY

3. Without reference, identify principles related to the tools and equipment used in miscellaneous firefighting. Eighty percent of the principles must be identified correctly

a. Tools

   (1) Spanner Wrench

      (a) Used for gas cut-off

- (2) Double bit axe
    - (a) Used for chopping and cutting
- (3) Single bit axe
    - (a) Used for cutting
- (4) Shovel
    - (a) Used to move earth
- (5) Fire rake
    - (a) Used to rake and carry light brush
- (6) Leaf or broom rake
    - (a) Used to sweep path
- (7) Pike Pole
    - (a) Used to seperate materials
- (8) Bolt cutters
    - (a) Used to cut certain size wires and cables
- (9) Saws
    - (a) Used for cutting materials
- (10) Claw tool/crow bar
    - (a) Used for prying
- (11) Door opener
    - (a) Used for prying

b. Special Equipment

- (1) Bulldozers
    - (a) Used to push materials into depressions
- (2) Graders
    - (a) Used to cover up materials

(3) Portable Pumps

  (a) Used to pump water from one area to another

(4) Back Pump

  (a) Used for suppression

(5) Water Tanker

  (a) Used as a source of limited water supply

Application: TIME: N/A

Evaluation: Intersperse throughout lesson TIME: 5 min

CONCLUSION TIME: 5 min

Summary: Recover main points of lesson.

Remotivation: Every fireman must keep himself abreast of the various methods employed in miscellaneous firefighting. Never will you find any two fires or situations the same.

Assignment: Read and study SG-109, Missiles and Weapons Fire Protection and answer the questions at the end of the unit. Accomplish PT-109, Radiation Hazards for Firefighters in its' entirity.

Closure: You, as proficient firemen, must be aware of the changing conditions you face each time you respond to an emergency. Know your job well, because others will depend on you.

OPERATION AND SERVICING OF PORTABLE EXTINGUISHERS

INTRODUCTION

TIME: 5 min

Attention: Some of you have probably seen the results of an engine fire or an interior fire in which the car was completely ruined because there were no effective ways of combating these fires in their early stages. This situation has happened within the Air Force; however, with the proper use of fire extinguishers this situation can be greatly reduced.

Review: In the previous lesson we discussed missiles and weapons and how to combat fires involving them.

Overview: During this class we will discuss and perform operation, servicing and maintenance on the common extinguishers utilized by the Air Force.

Motivation: To better perform our job and possibly prevent the loss of Air Force dollars and equipment due to fire, it is our job to insure proper operation and maintenance of fire extinguishers.

Transition: During the next hour we will be discussing the operation and servicing of portable fire extinguishers.

BODY

TIME: 5 hrs 50 min

Presentation

TIME: 1 hr 45 min

1. Given a portable fire extinguisher and WB, inspect the extinguisher in accordance with workbook checklist.

Use: WB-110
AFR 92-1

Use: Standard Air Force Fire Extinguishers

   a. Purpose of fire extinguishers

      (1) Appliance having limited capacity for an extinguishing agent

Stress energy and materials conservation

      (2) Extinguish or control fire in initial stages

   b. 2½ gallon pressurized water

      (1) Inspection

Show Film: FLC 16/101, "Portable Extinguishers"

         (a) Monthly - visual

            1. Pin and seal

            2. Hose and nozzle

Pressure Water Extinguisher

Use Chart CC 72-224

3. Tank for damage
4. Pressure (100 psi)
5. Gauge
6. Location
7. Instruction plate

(b) Annual

1. Visual
2. Discharge
3. Reservice
4. Relocate

(c) General Information

1. Class "A" fires
2. Range 30-40 feet
3. Hazard - conductor of electricity

c. 2½ gallon foam

Foam Extinguisher

Use Chart CC72-223

(1) Inspection

(a) Monthly - visual

1. Hose and nozzle
2. Tank for damage
3. Instruction plate
4. Location

(b) Semi-annaul - visual

1. Check for quality and quantity of chemicals

(c) Annual

1. Visual
2. Discharge

- 3. Clean and reservice
- 4. Reservice

(d) General Information

- 1. Class "B" fires
- 2. Range 30-40 feet
- 3. Hazard - conductor of electricity

d. Carbon Dioxide - CO2

Stress Safety

Carbon Dioxide Fire Extinguisher

Use Chart CC72-222

Use Chart CC65-161.1

Wheeled Carbon Dioxide Extinguisher

(1) Inspection

(a) Monthly - visual

- 1. Hose and horn
- 2. Cylinder for damage
- 3. Instruction plate
- 4. Location
- 5. Pin and Seal

(b) Semi-annual - visual

- 1. None

(c) Annual

- 1. Visual
- 2. Weight check (10%)

(d) General Information

- 1. Class "B" and "C" fire
- 2. Range 3-8 feet (hand type)
- 3. Hazard-high pressure - (800-875 psi)
- 4. Displaces oxygen
- 5. Frost bite
- 6. Sizes 2-100 lbs - 15 and 50 most common

7. Temperature when winterized -65° to +160°F

e. Dry chemical extinguisher

(1) Inspection

(a) Monthly - visual

1. Hose and nozzle

2. Location

3. Cylinder condition

4. Pin and seal

5. Pressure gauge (stored pressure

(b) Semi-annual

1. Weight check cartridge only

(c) Annual

1. Operate

2. Clean

3. Reservice/maintenance

4. Relocate

(d) General information

1. 1-30 lbs (hand type)

2. 75 to 350 lbs (wheel type)

3. Class "B" and "C" fires

4. Range may be from 5-45 feet dependent on size and type of extinguisher used

INTERIM SUMMARY

2. Without reference, identify procedures for repairing or replacing parts on extinguishers. Eighty percent of the procedures must be identified correctly. Stress Safety

a. 2½ gallon pressurized water extinguisher

(1) Charging procedure

  (a) Invert extinguisher (bleed off pressure)

  (b) Remove cap (fill with 2½ gallons of water)

  (c) Replace cap, charge to 100 PSI

  (d) Replace pin and new seal

(2) Winterization

  (a) 32° to 0° F replace water with Kiloy

  (b) Below 0° F replace water with Kiloy and replace air with dry nitrogen pressure

(3) Inspection and Maintenance

  (a) Monthly - visual

  (b) Semi-Annual - none

  (c) Annual

    1. Visual

    2. Operate

    3. Clean and recharge

b. 2½ gallon foam extinguisher

(1) Charging procedure

  (a) Remove cap - clean inside of chamber

  (b) Aluminum sulfate (PKG "A") mixed with 2½ pints of water in inner chamber

  (c) Sodium bicarbonate (PKG "B") mixed with 1-3/4 gallons of water in outer chamber

  (d) Secure cap and gasket to cylinder

- (2) Winterization
  - (a) Cannot be winterized
  - (b) Keep in warm area
- (3) Inspection and maintenance
  - (a) Monthly - visual
  - (b) Semi-annual
    - 1. Visual
    - 2. Check inner chamber for quantity and quality of agent
    - 3. Check outer chamber for quantity and quality of agent
    - 4. Make sure lead stopper is loose
    - 5. Check condition of gasket
    - 6. Replace cap
  - (c) Annual
    - 1. Visual
    - 2. Operate
    - 3. Clean and Recharge

c. Carbon Dioxide (CO2) Stress Safety

- (1) Recharging procedures
  - (a) High pressure pump
    - 1. Items to be used
      - a. Extinguisher to be used
      - b. Scale
      - c. Transfer pump
      - d. Supply cylinder

2. Invert extinguisher on scale and note full and empty weight (set scale)

3. Invert supply cylinder

4. Attach hose for both cylinders

5. Caution - insure all hose connections are tight and proper sequence of steps are followed - extreme caution is necessary because of high pressure

6. Close valve on transfer pump, open valve on extinguisher

7. Open valve on supply cylinder and transfer pump (CO2 will flow to equalize)

8. After CO2 equalizes, start transfer pump and operate until ful weight is reached

9. Shut down in rapid succession as follows

   a. Transfer pump

   b. Close extinguisher valve and fill line then slowly disconnect (Caution - high pressure, release)

(2) Winterization — Stress Safety

(a) For all airborne fire extinguishers or those stored or operated at 0°F temperatures or below

(b) Add 200 psi of dry nitrogen @ 70°F

(c) Purpose: To insure 200 psi operating pressure when sub-zero temperatures reduce CO2 to a liquid state

(3) Inspection and Maintenance

(a) Monthly

1. Hose and horn

2. Pin and Seal

3. Plastic cap and safety disc

4. If seal or cap are not intact a weight check is required

(b) Semi-annual - none

(c) Annual

1. Visual

2. Weight Check

3. Recharge if agent is below

d. Dry chemical Extinguisher

(1) Recharging procedures - by different methods as outlined on inspection-operation plate

(2) Winterization - None

(3) Inspection and maintenance by different methods as outlined by inspection-operation plate

INTERIM SUMMARY

3. Given a portable fire extinguisher and WB, recharge the extinguisher in accordance with workbook checklist, while observing all safety precautions.

Use: Standard Air Force Fire Extinguishers, Standard Air Force Extinguishing Agents, Floor Scales, Hi pressure CO2 Transfer Pump, Tilting Rack, High Pressure CO2 Bottles

SAFETY WHILE RECHARGING WITH HIGH PRESSURES

a. 2½ gallon pressurized water

(1) Repairing procedures

(a) Replace parts if defective

(b 1. Pin and seal

2. Hose and nozzle

3. Cylinder/damaged - dented

4. Pressure gauge

5. Instruction Plate

6. Siphon Tube

b. 2½ gallon foam

(1) Repairing Procedures

(a) Replace parts if defective

1. Hose and nozzle

2. Cylinder/damaged-dented

3. Instruction plate

c. Carbon Dioxide - CO2

(1) Repairing procedures, hand and wheel type

(a) Replace parts if defective

1. Hose and horn

2. Cylinder/damage - dents

3. Instruction plate

4. Pin and seal

5. Wheel type

a. Extinguisher cart

b. Wheels

d. Dry Chemical

(1) Repairing procedure

(a) Replace parts if defective

1. Hose and nozzle

2. Cylinder/damage-dents

3. Instruction plate

4. Pin and seal

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5. Pressure gauge

6. Wheel type

   a. Extinguisher cart

   b. Wheels (free movement)

   c. Hose cart

4. Given a portable fire extinguisher and WB, perform operational test on extinguisher by completely extinguishing a fire with minimum instructor assistance. All safety precautions will be observed.

Use: Standard Air Force Fire Extinguishers, Minature Burn Pans

SAFETY ON LIVE FIRES

a. 2½ gallon pressurized water

   (1) Testing procedures

      (a) Pressurize to 100 PSI

      (b) Stabilize pressure

      (c) Check for leaks

         1. Head assembly

         2. Pressure gauge

         3. Cylinder body

b. 2½ gallon foam

   (1) Testing procedures

      (a) Extinguisher tested during yearly check by placing extinguisher into operation

c. Carbon Dioxide CO2

   (1) Testing procedures

      (a) Pressurize extinguisher 800 PSI

      (b) Check for leaks

         1. Head assembly

         2. Safety disc

         3. Cylinder body

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d. Dry Chemical

   (1) Testing procedures

      (a) Pressurize extinguisher

      (b) Stabilize pressure

      (c) Check for leaks

         1. Head assembly

         2. Pressure gauge

         3. Cylinder body

Application: TIME: 4 hrs

Intersperse throughout lesson **2 INSTRUCTORS ARE REQUIRED**

Evaluation: TIME: 5 min

Intersperse throughout lesson

CONCLUSION TIME: 5 min

Summary: In this lesson we have discussed the purpose of fire extinguishers and the various characteristics of each which included the different type, size, operating principles, range, winterization procedures, inspection and servicing instructions.

Remotivation: A fire extinguisher can be and has been just as important as a fire truck. What if you responded to a fire with a fire truck that was out of agent or the pump did not work. It would be just as embarrassing and possibly just as disasterous as if you placed an extinguisher in an area, where a fire later started, that did not work.

Assignment: GROUP #1-Read and study SG-111, Fire Protection Publications and answer the questions at the end of the unit.

GROUP #2-Read and study SG-112, Protective Clothing, and answer the questions at the end of the unit.

Closure: This completes this lesson on operation and servicing or portable fire extinguishers.

PROTECTIVE CLOTHING

INTRODUCTION TIME: 5 min

Attention: Have you ever worked on a car and used coveralls to protect your good clothes? In the fire department we use protective clothing to protect us and enable us to do our job without having to worry about getting burned or soaking wet.

Review: Do you recall our lesson on Missiles and Weapons and the hazards involved when fighting fires containing weapons? Today we will learn about protective clothing.

Overview: During the next hour we will learn about the use and purpose of protective clothing and also the care, inspection, and maintenance of your protective clothing.

Motivation: What would it be like to go into a crash or structural fire without protective clothing. Think of being surrounded by 1200 degrees of heat or being soaked by accident during minus 20 degree weather.

Transition: Now we will begin our lesson by discussing and performing maintenance and inspection on protective clothing.

BODY TIME: 3 hrs 50 min

Presentation: TIME: 45 min

1. Given firefighting protective clothing, inspect protective clothing. Protective clothing will be maintained according to locally established policy as required.

Use: AFR 92-1
WB-112

   a. Protective clothing is required to enable fire suppression personnel to approach and attack fires and effect rescue with maximum personal safety from heat.

      (1) Purpose of protective clothing is to protect the wearer from:

(a) Flames and heat

(b) Radiated heat

(c) Radioactive hazards

(d) Water

(e) Cold weather

(f) Physical injury

(g) No protection from gamma radiation

Energy and training material conservation cleaning material and care of protective clothing.

b. Structural protective equipment is worn when:

Use complete set of special protective clothing. Structural Helmet.

(1) For normal fires involving basic class "A" combustible materials.

(a) Plastic moulded helmet

1. Cushioned head strap, adjustable from 6 3/4 to 7 3/4 inches

2. Adjustable chin strap

(b) Gloves

1. Leather shells

2. Wool inserts

(c) MA-1 Boots

1. 3/4 length

2. Rubber or synthetic foam and air space construction

INTERIM SUMMARY:

c. When special protective clothing is to be worn.

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(1) For extreme fire-intensity exposure to:

  (a) Flammable Liquids

  (b) Liquid or solid

    1. Fuels

    2. Propellants

    3. Chemicals

    4. Explosives

(2) MA-1 boots - same as used with structural protective clothing

(3) Aluminized special trousers - made of flame resistant and water treated asbestos and cotton outer cloth, coated with aluminum.

(4) Aluminized special coat - made of asbestos and cotton herring above twill outer cloth with aluminum coating and neoprene rubber coated nylon inner lining

(5) Aluminized special gloves

(6) A1B Hood

  (a) Outer cover of aluminized asbestos glass, neoprene coated fiberglass middle, and close woven wool inside

  (b) Framed with attached hard hat, adjustable chin strap

  (c) Thermo-setting plastic face piece

INTERIM SUMMARY:

d. Inspection and Maintenance

Use: worn/damaged protective clothing

(1) Daily and after each use, for damage from:

(a) Cuts

(b) Abrasions

(c) Burns

(d) Wear

(2) Thouroghly clean and dry clothing to prevent:

(a) Mildew

(b) Rotting

(c) Flaking of aluminized surface

(3) Protective clothing should be flushed off with water to remove:

(a) Fuels

(b) Extinguishing agents

(c) Oils

(d) Chemicals

(e) Dirt

(f) Mud

(4) Persistant residues may be removed with:

(a) Mild detergents

(b) Water

(c) No brush

(5) Protective Hood

(a) Clean outside cover same as coat and trousers

(b) Remove face piece glass and clean with soft cloth

INTERIM SUMMARY:

2. Given fire fighting protective clothing, don protective clothing within two minutes.

a. Donning protective clothing is very simple, but steps must be followed to prevent accidents to ourselves.

Demonstrate

Stress 2 min allowed for donning. (In the field more will be expected with proficiency experience)

(1) Donning procedures are:

(a) Remove shoes or boots

(b) Step into MA-1 boots, one foot at a time

(c) Pull trousers up and fasten suspenders

(d) Put on coat

(e) Fasten all snaps

(f) Turn collar up

(g) Put on hood

(h) Adjust chin strap

(i) Put on gloves

Application:

TIME: 3 hrs

Interspersed throughout lesson

Evaluation:

TIME: 5 min

Interspersed throughout lesson

CONCLUSION TIME: 5 min

Summary: Restate why and when protective clothing is used, also why inspection and maintenance of protective clothing must take place and why each is needed.

Remotivation: The protective clothing you will be using in the field is the best that money can buy, but if you do not wear it properly or maintain it, it can easily become just worthless burnt rags ... with you inside.

Assignment: N/A - Prepare to administer measurement test and test critique for end of Block I.

Closure: As you go into the field, wear your protective clothing proudly because it is not just another uniform, it is the uniform of a firefighter.

INITIATE THE MEASUREMENT TEST AND TEST CRITIQUE

Technical Training

Fire Protection Specialist

17-2

BLOCK I
FIRE PROTECTION OBJECTIVES AND RESPONSIBILITIES

23 July 1975

CHANUTE TECHNICAL TRAINING CENTER

This supersedes 3ABR57130-1-SG/WB-100, 14 April 1971.
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MODIFICATIONS

Pages 1-22 of this publication has (have) been deleted in adapting this material for inclusion in the "Trial Implementation of a Model System to Provide Military Curriculum Materials for Use in Vocational and Technical Education." Deleted material involves extensive use of military forms, procedures, systems, etc. and was not considered appropriate for use in vocational and technical education.

Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-SG-104

FIRE PROTECTION OCCUPATIONAL SAFETY

OBJECTIVES

After completing this study guide and your classroom instructions, you will be able to:

1. Identify basic facts and principles relating to the objectives of industrial safety.

2. Identify safe and unsafe procedures involved in performing station duties.

3. Identify safe and unsafe procedures involved in the wearing of protective clothing.

4. Identify safe and unsafe procedures pertaining to mounting fire protection vehicles.

5. Identify safe and unsafe procedures involved in fighting fires.

INTRODUCTION

The right way is always the safe way. This, in just a few words, is the safety policy of this technical training school. As you learn the RIGHT way to fight a fire, you are also learning the SAFE way. Accidents do not just happen, in fact, most are caused by unsafe acts of people. Accidents are preventable. By emphasizing safety and enforcing a safety training program, the accident rate will go down. Everyone must be able to recognize safety hazards. Throughout your training, you will be taught to work safely. No one safety requirement is more important than the other; you must practice all equally.

INFORMATION

SAFETY IN GENERAL

Safety, generally speaking, is common sense. If you injure yourself or one of your fellow workers through "horseplay" or carelessness or by an unsafe act, you are not living up to your obligations or responsibilities. Good clean fun is encouraged among workers; but, when the fun leads to injury, it is not clean. Safety precautions cannot be overemphasized.

ACCIDENT PREVENTION HANDBOOK

The Air Force publication outlining the ground safety program is AFR 127-101. "Accident Prevention Handbook." As we stated above, accidents are preventable. Safety education, good training, and careful supervision are all needed if we are to have accident-free operations. Accidents seriously affect the combat capability of the Air Force by causing manpower losses and equipment and material damage. The accident prevention handbook will serve as a source of information and guide for the prevention of ground accidents. AFR 127-101 also covers the handling of material and equipment that could present hazards. The main purpose of this regulation is to provide safe operating standards for ground operations and to aid in eliminating accidents.

AIR FORCE ACCIDENTS

About one-fifth of all Air Force ground accidents can be traced to unsafe operation of private vehicles. As a source of off-duty pleasure, the automobile rates top billing with Air Force personnel. Unfortunately, it is also their greatest threat to life and limb. The following reasons account for 90% of all private vehicle accidents.

1. Exceeding speed limits.

2. Excessive speeds for the road conditions.

3. Fatigue and falling alseep.

4. Disgarding traffic controls.

5. Driving on the wrong side of the road.

6. Following too closely.

7. Unsafe or improper passing.

CONTROL OF ACCIDENTS

Even accidents caused by nature can be controlled to some extent. Only accidents resulting from natural elements such as lightning, storms, and/or floods are hard to prevent. The effects of natural elements can be minimized. For example, aircraft can be secured when strong winds are expected. Accidents due to nature, called "Acts of God," represent only two percent of all accidents. Some preventable accidents can be traced to unsafe acts and attitudes starting in early childhood. These unsafe childhood habits are further developed as a person grows older and accepts a job. The injuries, property damage, and loss of time, which follows, complete the costly cycle. Always be on the lookout for unsafe habits of others and your own. You should try to correct your own unsafe habits and tactfully tell others of their unsafe habits.

Government Motor Vehicle Operation

Approximately one-fifth of all United States Air Force ground accidents result from government motor vehicle operations. However, less than five percent of all injuries are caused by the operation of government vehicles. The reason for the low injury rate is that most government vehicles operate on Air Force installations at low speeds. The following reasons account for approximately three-quarters of all military vehicle accidents:

1. Backing without spotters at the rear of a vehicle.

2. Excessive speed for road conditions.

3. Exceeding speed limits.

4. Following too closely.

5. Failure to yield right-of-way.

FIRE PROTECTION ACCIDENTS

Let's face it, firefighting can be an unsafe business. Nevertheless, you will find a very low accident rate in this field. The reason for the low rate is that there are some simple rules to follow when working in the fire service. We cannot write a simple paragraph to cover every dangerous job in this field, but there are some very important rules that could save your life listed in the following paragraphs.

Vehicles and Equipment

1. Never crawl under a truck to clean or repair unless someone is present to prevent another person from starting the truck.

2. Never attempt to clean an engine while it is running.

3. Be sure the truck is safely blocked when wheels are being changed.

4. Use the proper tools when making adjustments or repairs.

5. When driving a truck in reverse, always have someone walk in back to guide you.

6. Do not mount or dismount from a vehicle while it is in motion.

Responding to a Fire

When responding to a fire or an emergency, the driver should maintain a safe speed and be alert at all times. Drivers of emergency vehicles will not assume the right-of-way over other vehicles, and will comply with state and local traffic laws and applicable military regulations governing vehicle operations. (Reference: AFR 77-2, when responding to an emergency call, emergency vehicles may proceed through a stop signal or stop sign, if not in violation of local law, but only after slowing down or stopping to assure safe operation.) Some people disregard emergency vehicles and may not yield. Avoid accidents regardless of circumstances, for a wrecked fire truck or injured firefighter will be of no value at the fire or emergency. When returning to the station, the driver must observe all traffic regulations.

Laying Hose at the Fire

When hose is coming out of the hose bed with the fire truck in motion, the hoseman should ride in the cab whenever possible. This is to keep from being struck by the whipping hose or couplings at the rear of the truck.

Entering Burning Building

When opening doors or windows to enter a burning building, stand to the side of the opening because there is a possibility of explosions or flying glass or wood when the door or window is opened.

Forcible Entry Tools

Serious injury can result from improperly used forcible entry tools such as crowbar, fire axe, door opener, and power saw. These tools must be handled carefully. During this course, you will be taught the proper use of these tools.

ACCIDENT REPORTING

All people should promptly report all accidents to their immediate supervisor. When accidents are not reported promptly, both the Air Force and the injured person may suffer financial loss.

QUESTIONS

Answer these questions on a separate sheet of paper which will be given to your instructor for correction and evaluation. Do not write in this book.

1. No ____________ safety requirement is more important than the other, you ____________ practice all equally.

2. The Air Force publications outlining the ground safety program is AFR ________ ____________, Accident ______________ Handbook.

3. The main purpose of AFR __________ ____________ is to provide safe __________ standards for ground ______________ and to aid in eliminating ____________________.

4. Accidents due to nature, called Acts of God, represent only __________ percent of ______________ accidents.

5. Some preventable accidents can be traced to ____________ acts and attitudes starting in ______________ childhood.

6. Only accidents resulting from natural elements such as ______________ ____________________ and/or floods are hard to prevent.

7. When responding to a fire or an emergency, the driver should maintain a _______ speed and be ______________ at all times.

8. When opening doors or windows to enter a ____________ building ____________ to the side of the opening because there is a possibility of __________________ or ______________ glass or ____________ when the door or window is opened.

9. When returning to the station, the ________________ must observe all ________ regulations.

10. All ________________ should promptly ______________ all accidents to their ____________________ supervisor.

REFERENCES

1. AFR 127-101, Accident Prevention Handbook.
2. AFR 92-1, Fire Protection Program.

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EXTINGUISHING AGENTS

OBJECTIVES

After completing this study guide and your classroom instructions, you will be able to:

1. Identify principles relating to suppression, control and extinguishment of fires.

2. Identify the characteristics of extinguishing agents by matching proper agents to classes of fires and associated hazards.

INTRODUCTION

It is essential for the fire protection specialist to know how extinguishing agents are applied in order to maintain our objective, i.e., to save lives and property from fire. To use the wrong extinguishing agent on a fire, could result in injury, excessive loss of property, explosion and possible death. As you can see this could affect the mission of an entire installation.

In this text, we will cover the extinguishing agents that are commonly found and utilized on Air Force installations. We will also explain the class of fire for which each is recommended, and how they are used to control or extinguish a fire. The safety precautions that the fire protection specialist must take with certain agents will also be explained.

INFORMATION

In the study of the chemical and physical phenomenon of fire you will learn that the three components, fuel, heat and oxygen, are necessary in proper proportions for a fire to occur. In the extinguishment process, the removal of one or more of these components must take place.

EXPLANATION OF TERMS

Control - To prevent the spreading of a fire or place it in check so that propagation or spread will not take place.

Cooling - Removal of the heat from a burning material faster than the heat can be generated, or reducing the temperature of the material to the point where fuel vapors can no longer be produced is removal of the "heat" portion of the fire triangle.

Smothering - The separation of the oxidizing agent (air) from the fuel.

Suppression - Any action, such as using an extinguishing agent that affects the fire by controlling or eliminating the various elements that supports combustion.

Extinguished - The result of having applied an extinguishing agent to stop the process of rapid oxidation by the removal of either heat, oxygen, or fuel.

Extinguishing Agent - Chemicals, whether solid, liquid or gas (vapors) used to control or extinguish a fire.

EXTINGUISHING AGENTS

Water

This is the most common of the extinguishing agents. Water is the recommended agent for use on class "A" type fires, i.e. wood, paper, coal, because of its ability to absorb the heat being generated faster than it can be produced by the material burning when the water is applied in bulk, straight or solid streams. When water is applied in a spray or fog pattern in a heated area, steam is produced providing a secondary effect of smothering. Because water in its natural state contains impurities it is conductive. Applying water to fires involving "live" electrical equipment is not recommended because of the shock hazard to the user.

Wet Water

When deep seated class A fires occur, such as in mattresses, hay, or cotton bales, water in its natural state may not be able to penetrate fast enough to quench and cool the fire. Therefore additives such as special detergents are combined in proportions with water to give it the ability to penetrate for fires that are deep seated.

Foam

Currently the Air Force uses three types of foam: chemical, mechanical, and AFFF. Chemcal foam is used in 2-1/2 gallon foam type fire extinguishers. Chemical foam is formed by mixing sodium bicarbonate with water and aluminum sulphate with water. When the water, sodium bicarbonate and the aluminum sulphate are mixed together, a chemical reaction takes place producing the finished foam product. The sodium bicarbonate is mixed with 1-3/4 gallons of water and it is placed in what is known as the outer chamber of the foam extinguisher. The aluminum sulphate is mixed with 2-1/2 pints of water and placed in a tube which is inserted in the center of the foam extinguishers. When this type of extinguisher is inverted a chemical reaction takes place producing CO_2 pressure within the extinguisher to expel the agent from the extinguisher.

Mechanical Foam

This comes in a liquid composed of a high protein base substance formed chemically from vegetable and animal protein. The Air Force uses what is known as "6% foam." It contains 6% of foam concentrate mixed with 94% water (atmospheric conditions permitting). To explain, this water-foam solution must also be mixed with air. Mechanical foam is primarily used in aerospace fire crash/rescue vehicles for runway foaming operations only. The foam concentrate is taken in the water lines on the discharge side of the pump and when the mixture reaches the outlet air is inducted into the mixture. Air bubbles are formed allowing the mixture to expand approximately 10 times thus the type A/S 32P-2 crash truck is capable of producing approximately 25,000 gallons of finished foam.

Aqueous Film Forming Foam

Aqueous Film Forming Foam (AFFF) is the third type of foam agent used in the Air Force. It is a film forming foam which has the ability of making water float on class "B" flammable fuels.

The mixture of this foam agent and water is the same as with mechanical type foam. It contains a mixture of 6% foam concentrate and 94% water. When properly proportioned, it has an expansion ratio of 8-10 to 1 and generates a white, nontoxic blanketing foam film.

AFFF can be used with all types of discharged nozzles including fixed or mobile systems. It is not necessary to mix the solution with air to produce foam. As is true with chemical and mechanical foam, AFFF extinguishes the fire by smothering.

Use of Foam

Foam is the recommended agent for use on class "B" fires. It provides a smothering blanket on the surface of the burning material to exclude the air (oxidizing agent) and it also keeps the vapors from being emitted from the hot fuel.

Mechanical foam is used on runway foaming operation, and may also be used to blanket large fuel spills. Foam should not be used on electrically energized equipment since foam is a conductor of electricity. This is due to all the impurities mixed with the water.

Carbon Dioxide

This agent in its natural state is a gas. The carbon dioxide gas is noncombustible and it is about one and one-half times heavier than air. When CO_2 first comes in contact with air, its temperature may be as low as 110°F. Carbon dioxide is in the liquid state and under pressure when it is transferred from one container to another. In the USAF, carbon dioxide is utilized in fire extinguishers (high pressure systems) and storage tanks (low pressure systems). Carbon dioxide is recommended for use on class "B" type fires. It will move along the surface of the burning material, smothering the fire by exclusion of the oxygen. Carbon dioxide is recommended for use on class "C" type fires, since the vapors do not conduct electricity. Carbon dioxide is noncorrosive in nature and does not leave any harmful deposits. Carbon dioxide should not be used in confined areas when human life is involved due to its oxygen-displacing capabilities.

Dry Chemical

The USAF uses dry chemical in hand fire extinguishers and it is effective for the extinguishment of class "B" and "C" type fires. Dry chemicals are primarily composed of sodium bicarbonate or potassium bicarbonate. When dry chemicals are exposed to the high temperatures of a fire, the agent is converted to sodium or potassium carbonate, carbon dioxide, and water vapor and will extinguish the fire by smothering. Dry chemical agents are nontoxic.

Dry Powders

Dry powders are used on combustible metal fires (class "D"). Three of the most commonly found on USAF installations are Pyrene G-1, Met-L-X and Lith-X. Pyrene G-1 is composed of screened graphatized foundary coke to which organic phosphate has been added. The graphite acts as a heat conductor and absorbs the heat from the fire to lower the metal temperature below the ignition point, and the closely packet of graphite also acts to smother the fire. The combined action is involved in the extinguishment of the material.

Met-L-X starts with a sodium chloride base in sized particles. Thermoplastic materials are also added to act as a binder when applied to burning metals. When this agent is applied, a crust is formed over the material to exclude the air, thereby smothering the fire.

Lith-X is composed of a special graphite base in powder form with additives to make it free flowing so it can be used in fire extinguishers. This agent will exclude air from the material burning, therefore smothering the fire. This agent does not cling to the material so it is necessary to completely cover the metal involved in fire. Because of the extreme heat created by class "D" fire, extreme caution should be exercised whenever combatting this type of fire.

Note: Water will not be used. Whenever using dry powders, extreme care should be utilized during the application, and completely cover the metal involved with these agents.

There are no health hazards involved with the dry powders mentioned. Since the probabilities of a class "D" fire becomes involved with or around electrically energized equipment, the conductivity of these agents is not relative. It should be noted that Pyrene G-1 and Lith-X are capable of conducting electricity.

QUESTIONS

Answer these questions on a separate sheet of paper which will be given to your instructor for correction and evaluation. Do not write in this book.

1. To prevent the spreading of fire, or place it in check to where ______________ will not take place is called ________________.

2. Removal of the ___________ faster then it can be __________________ is called ________________.

3. The results of stopping the process of ________________ is called ___________.

4. Any action that affects the fire by _____________ or elimination is called ______________________.

5. __________________ foam is used in fire extinguishers.

6. Chemical foam consists of two chemicals, the _________ ___________ is mixed with ___________ gallons of water and is placed in the ___________ chamber. The _____________ _____________ is mixed with ___________ pints of water and is placed in the ______________ chamber.

7. Carbon dioxide should not be used in ______________ areas due to its ________ ____________ capabilities.

8. Wet water is used on ____________ ____________ class "A" fires.

9. _____________ foam is the only foam used in runway foaming operations.

REFERENCE

1. AFR 92-1, Fire Protection Program.

PRINCIPLES AND THEORY OF COMBUSTION

OBJECTIVES

After completing this study guide and your classroom instructions, you will be able to:

1. Identify principles relating to chemistry and physics of combustion.

2. Identify characteristics and hazards of flammable materials.

INTRODUCTION

The history of fire began with the first stages of man. Fire has been an essential factor in the development of civilization ever since its discovery. It is also true that many great disasters and much destruction have resulted from fire. It is understandable, then, that seldom is the subject of fire mentioned that it does not induce fear. The purpose of this study guide is to familiarize you with the various properties of fire so that you may have a basic understanding of fire, eliminate this inherent fear, develop a healthy respect for fire, and perform the various fire protection functions intelligently. During this subject, your instructor will perform several demonstrations to illustrate some of the important points.

INFORMATION

WHAT IS FIRE?

Basically fire (combustion) may be defined as rapid oxidation with the evolution of light and heat. You must know when a material will oxidize rapidly enough to produce light and heat. Understanding this will help you in controlling and extinguishing fires. This knowledge will also help you to understand and practice fire prevention principles which are a vital function of the fire protection organization.

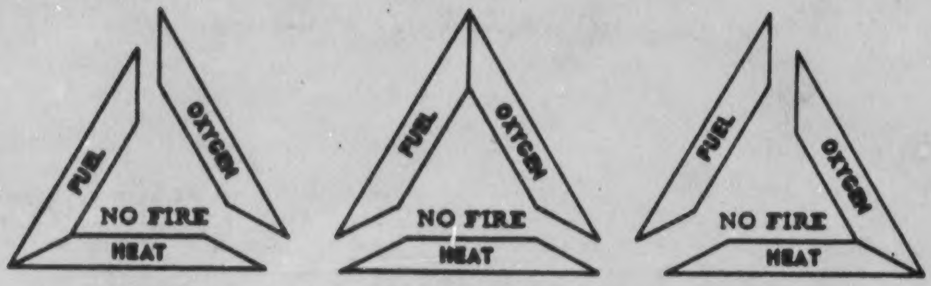
COMPONENTS

Combustion or fire may be broken down into three basic components. These are fuel, heat and oxygen, all of which must be present and in the proper proportions to create a fire. These components are often compared to the sides of a triangle called the fire triangle. Figure 4 shows the three components of fire separated and properly combined. Notice in the triangle that only when all three components are combined in their proper proportions will fire exist. Since each of these components is essential for fire, let us discuss each one individually.

Fuel

Fuel can be defined as any substance or material (solid, liquid or gas) used to produce heat or power y combustion. Ordinarily, when the term fuel is mentioned, you think of materials such as wood, paper, coal, gasoline, etc. However, from the chemical standpoint, only the fuel elements are considered in determining what is classified as a fuel. To understand how a fuel burns, we must first discuss the fuel elements. The common fuel elements are carbon, hydrogen and sulphur, all of which emit flammable vapors. All common fuels contain one or more of these elements. In some forms, such as wood, they must be heated to release flammable vapors while in other forms, such as gasoline, vapors are readily given off at room temperatures. It must be understood that most fuels must be in vapor form to burn. This explains why some fuels are more difficult to ignite than others. Fuels, when heated, will go through several stages such as flashpoint and firepoint.

FLASHPOINT of a substance is that temperature at which a fuel gives off a very limited amount of vapors. When these vapors are mixed with air and ignited the flame will flash across the surface but will not continue to burn.



OXYGEN REMOVED

HEAT REMOVED

FUEL REMOVED

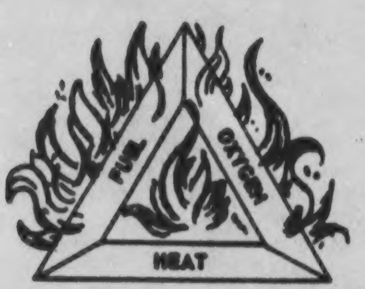


Figure 4. Fire Triangle.

FIREPOINT of a substance is the lowest temperature at which vapors are given off fast enough to support continuous combustion when mixed with air and ignited.

At both flashpoint and firepoint, only vapors are given off and will not burn unless ignited by some external heat source.

IGNITION TEMPERATURE of a substance is that temperature required to initiate or cause self-sustained combustion independent of an outside source of ignition. The ignition temperature will vary for each given fuel. Some of the conditions which may effect the ignition temperature of liquides and gases are the percentage of vapor or gas and air mixture, size and shape of area where ignition takes place.

The ignition temperature range for most ordinary combustible materials varies between 300° to 1,000°F.

The heat necessary for ignition may come from an external source, such as flame, spark or friction. It may also be generated within the substance itself. This can be caused by a chemical union of the oxygen in the air and the substances and is called spontaneous heating. Oily rags and stored green hay are examples of some materials subject to spontaneous heating.

If spontaneous heating of a material is allowed to continue and the generated heat is confined to the material, the temperature of the material will continue to rise until it reaches its ignition temperature. This self-ignition of a material is called spontaneous ignition. An example of spontaneous ignition is a fire in stored, oil rags without the application of heat from some external source. This chemical reaction can and does take place in many substances and is the cause of many fires in such places as family dwellings, hospitals and nursing homes.

CLASSES OF FIRE

To aid the firefighter in selecting a suitable agent to extinguish a fire, it has been necessary to group fires into four general classes. Classes of fire, types and examples are as follows:

Classes	Type	Examples
A	Natural Fibers	Wood, paper, trash, etc.
B	Liquids	Fats, oils, greases, gasoline
C	Electrical	Involves electrical current and when electrical current is turned off may be either class A or B fire
D	Metals	Combustible metals such as magnesium

Heat

Basically, heat is defined as that condition which causes the temperature of a substance to rise. Heat may be produced from any of the energy producing sources as shown below:

Energy Source	Examples
Mechanical	Friction
Chemical	Oxidation
Electrical	Spark, lightning
Compression	Filling of storage tanks
Solar	Sun's rays
Atomic	Atomic fusion

The three most common sources which may be encountered daily are mechanical energy, chemical energy and electrical energy. You have already learned of flashpoint and firepoint. These are temperatures of a fuel at which flammable vapors are given off and even though they are mixed with air will not burn unless ignited from an external source.

Oxygen

Oxygen, an element, is an odorless, colorless, and tasteless gas forming approximately 21% of the air we breathe. Oxygen, itself, is nonflammable; however, it actively supports and accelerates combustion. In order for an oxidation reaction to take place, a combustible substance (fuel) and an oxidizing agent must be present. The most common oxidizing material is the air we breathe. Oxidation may be divided into three general classes:

1. Slow oxidation takes place in rust and wood rot. Oxidation is taking place so slowly that the heat generated is given off as fast as it is produced.

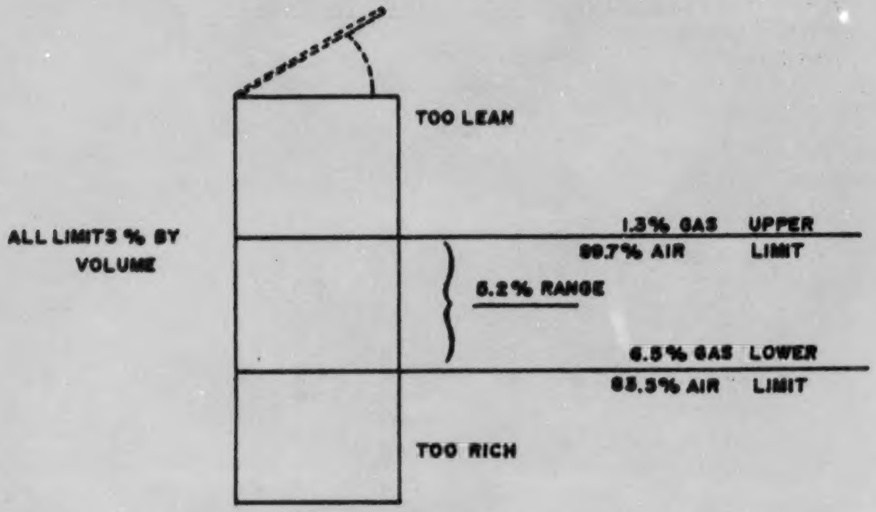
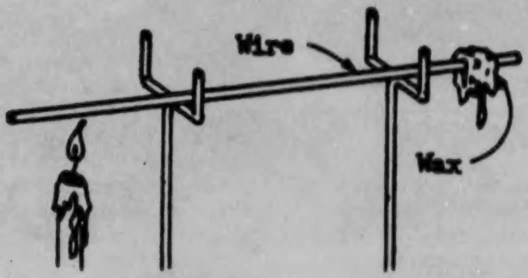
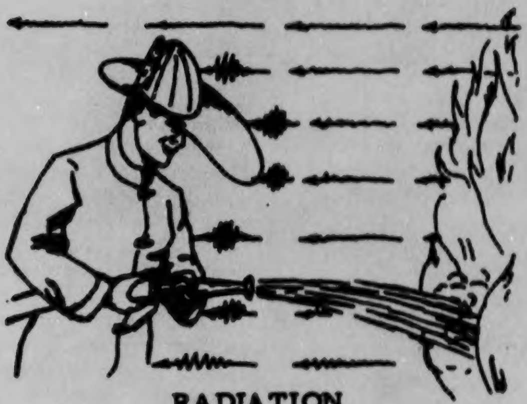


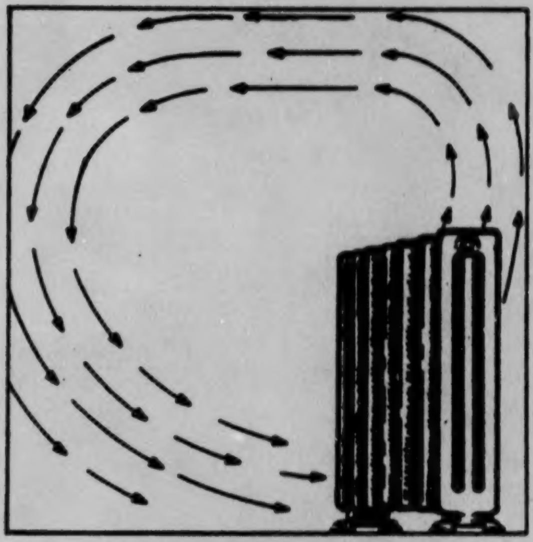
Figure 5. Explosive Limits of Gasoline.



CONDUCTION



RADIATION



CONVECTION

Figure 6. Transfer of Heat.

2. Rapid oxidation takes place in combustion. Oxidation is rapid enough to produce light and heat that can be seen and felt.

3. Ultra-rapid oxidation occurs during explosions. Oxidation is so rapid that it appears to be instantaneous.

The major difference between the three classes is the amount of heat given off during a period of time and the rate of fuel consumption.

OXIDIZING AGENTS

Oxidizing agents are of great concern to the fire protection specialist because they readily yield oxygen to stimulate combustion. Some oxidizing agents that will intensify or increase the burning rate are chlorates, nitrates and peroxides, all of which give off oxygen readily, especially when heated or involved in fire.

EXPLOSIVE LIMITS

The mixture of air with fuel vapors forms the explosive limits of each fuel. Explosive limits range from the minimum to the maximum concentrations of fuel vapors and air that will burn or explode on contact with a source of ignition. The minimum amount of fuel vapors mixed with air that will either burn or explode is called the lower explosive limits. The maximum amount of fuel mixed with air that will burn or explode is called the upper explosive limits. Anywhere in between these two limits is called the explosive range. The explosive range of gasoline is shown in figure 5. NOTE: The intensity of a fire varies with the concentration of fuel vapors.

Here are other gases and their explosive limits.

Fuel	Lower Limit	Upper Limit
Acetylene	2.5%	80.0%
Butane	1.6%	8.5%
Propane	2.4%	9.5%
JP-4	1.3%	6.5%

Definition of terms used in combustion:

1. Intensity - the force of energy of a physical agent and is proportional to the vapors given off and the rate of air supply.

2. Propagation - may be defined as the spread of fire.

3. Magnitude - may be defined as the size or greatness of the area involved. The magnitude of the fire is dependent on the surface area of the fuel which is exposed to the air. The more surface area exposed, the greater the magnitude.

HEAT TRANSFER

Transfer of heat is responsible for the start and extinguishment of most fires, figure 6. Fire propagates (spreads) through the transmission of heat, liberating fresh vapors to support combustion. Heat may be transferred by one or more of the following methods:

1. Conduction - the transfer of heat from one body to another by direct contact.

2. Convection - the transmission of heat by moving currents, either a liquid or gas. Most homes are heated by convection.

3. Radiation - the transmission of heat from a heated body to a colder one by heat rays through intervening space. Heat transfer by radiation is much the same as light transferred by light rays. Thus, heat coming to us from the sun or from close proximity to a fire is an example of radiation.

PRODUCTS OF COMBUSTION

Combustion results in the liberation of certain other compounds, called the product of combustion. The action is a result of the chemical change and the union of oxygen with the fuel elements. While there are many gases given off in the burning process, four of the most common gases that will be present in most fires are:

1. H_2O - water vapor - which is the union of hydrogen and oxygen during combustion.

2. SO_2 - sulphur dioxide or the uniting of sulphur and oxygen.

3. CO_2 - carbon dioxide or the uniting of carbon and oxygen. CO_2 is an inert gas and is the result of complete combustion.

4. CO - carbon monoxide - a result of incomplete combustion, such as in smoldering fires and is a highly flammable and toxic gas.

In summarizing, the science of fire protection rests on these principles; (1) an oxidizing agent, a combustible material, and an ignition source are necessary for combustion, (2) the combustible material must be heated to its firepoint before it will burn and (3) combustion will continue until the fuel is consumed or removed or until the oxidizing agent or air is below the point which will support combustion, or the combustible material is cooled below its ignition temperature. Every method for prevention, control or extinguishment of fire is based on one or more of these principles.

QUESTIONS

Answer these questions on a separate sheet of paper which will be given to your instructor for correction and evaluation. Do not write in this book.

1. Fire (combustion) may be defined as ____________ ____________ with the evolution of ____________ and ____________.

2. Combustion of fire may be broken down into three basic components which are ____________ ____________ and ____________.

3. Fuel can be defined as any substance or material (________, ____________ or ____________) used to produce ____________ or ____________ by combustion.

4. Fuel elements are ____________, ____________ and ____________ all of which emit flammable vapors.

5. If spontaneous heating of a material is allowed to continue and the generated heat is confined to the material, the temperature of the ____________ will continue to rise until it reaches its ____________ temperature.

6. To aid the firefighter in selecting a suitable agent to ____________ a fire, it has been necessary to group fire into ____________ general classes.

7. Heat is defined as that ____________ which causes the ____________ of a substance to rise.

8. The three most common sources which may be encountered daily are ____________ energy, ____________ energy, and ____________ energy.

9. Oxidation may be divided into three general classes which are ____________ oxidation, ____________ oxidation and ____________ oxidation.

10. The minimum amount of fuel vapors mixed with air that will either burn or explode is called the ____________ ____________ limits.

11. The maximum amount of fuel mixed with air that will burn or explode is called the ____________ ____________ limits.

12. The transmission of heat by moving currents is called ____________.

13. The transmission of heat from one body to another by direct contact is called ____________.

14. Heat coming to us from the sun or from close proximity to a fire is called ____________.

REFERENCE

1. AFR 92-1, Fire Protection Program.

Fire Protection Branch
Chanute AFB, Illinois

NATURAL COVER FIRES

OBJECTIVES

After completing this study guide and your classroom instructions, you will be able to:

1. Identify principles involved in natural cover firefighting.

2. Identify the principles involved in various methods of controlling and extinguishing natural cover fires.

3. Identify principles relating to the tools and equipment used in natural cover firefighting.

INTRODUCTION

Natural cover fires involve grass, weeds, grain, brush, forest or any other plant life. Forest fires are no doubt the most costly and far reaching of all natural cover fires. Forest fires involve more than the immediate monetary loss. This is insignificant when compared with the effect on the future water and timber supply, plus the loss of hunting, fishing, and recreational facilities; to say nothing about the loss of life that may occur. Forest fires are also of great concern to fire protection personnel because they frequently involve farms, villages and towns. For this reason fire protection organizations are called upon to combat both structural and natural cover fires.

INFORMATION

PREVENTION AND CONTROL

In recent years, the nation has become increasingly conscious of the importance of the prevention and control of natural cover fires, especially forest fires.

Causes

The great majority of natural cover fires are caused by man and are results of carelessness. The natural elements, such as lightning and the sun, are responsible for the remainder. Carelessness on the part of hunters, campers, fishermen and local residents account for more fires than any other cause. Some of the other causes are locomotives, burning rubbish, lumber operations, and arson.

Methods of Prevention

The most effective means of preventing natural cover fires are educational programs. These programs fall into the areas of law enforcement, established restrictions, education and training, and the complete elimination of fire hazards in critical areas.

Detection

Prompt discovery of these fires is essential in achieving quick control and limiting damage. In areas where efficient detection, control, and firefighting organizations are present, fires rarely get out of control, and damage is kept to a minimum. These methods of early detection are: ground and air patrols, and forest fire observation towers.

Use of Aircraft

Aircraft can also be effectively used in combatting and controlling natural cover fires. Various types of aircraft can be used, some to transport men and supplies, and some specifically to haul material to directly combat the fires. Aircraft are especially useful in remote areas that are devoid of trails and roads. Parachute jumping firefighters started training before World War II and they have expanded and improved their effectiveness each succeeding year. After the war, the Air Force conducted many experiments and tests, especially with the helicopter, in combatting natural cover fires.

For extinguishment of a forest fire with aircraft, the "water bomb" dropped at fire breaks and other airborne devices are being tested by the Air Force and civilian organizations.

EFFECTS OF NATURE (WIND, RAIN, AND DROUGHT)

The rate of burning of natural cover fires depends primarily on the velocity of the wind, type and abundance of fuel, and topographic conditions.

Effects of Wind

The wind can cause a natural cover fire to burn with greater intensity and cause it to propagate faster by carrying a greater amount of fresh oxygen to the fire. The wind also carries the heat to the unburned fuel thus causing it to vaporize faster.

Effects of Rain

Rain can be a great help in the control and extinguishmen of a natural cover fire. Water is a very good extinguishing agent on forest fires, especially when delivered on the fire as in rain.

Effects of Drought

Drought can greatly effect the burning of a natural cover fire. Primarily, it allows the fuel to become excessively dry. This, in turn, means that the fuel will vaporize more easily and in final result burn faster.

TYPES OF NATURAL COVER FIRES

The four distinct types of natural cover fires are: (1) ground fires, (2) surface fires, (3) crown fires, and (4) spot fires. Each type is subject to variation in speed of fire propagation, size, type and quantity of fuel involved.

Ground Fires

These are fires that travel at ground level or below the surface. Dry leaves, humus (material formed by decomposition of vegetable or animal matter in or on the soil) peat and other organic materials which have become part of the soil are the fuels.

Surface Fires

These are fires in grass, weeds, grain, rush, and shrubs. This type of fire travels above ground level and rapidly if the wind is high and the fuel is dry and abundant. The heat is intense but short lived because of the quick burning characteristic of the fuels.

Crown Fires

These are fires in the tops of trees and in high brush. When the heat is generated by burning fuels heat at the surface is intense, the fire advances upward on the dried lower limbs of trees and continues to burn in the tree tops. This condition occurs mostly in coniferous (cone bearing trees, such as pine and cypress) forests and then only on steep slopes, in draws and canyons, or during high winds. The crown fire is the most dreaded of all natural cover fires. The enormous flame areas sucks oxygen from the air for hundreds of yards from the fire line, which in turn, generates such intense heat that direct control is almost impossible. Indirect methods, such as fire breks, either natural or manmade, and backfiring are the best means of controlling large crown fires.

Spot Fires

These are fires started in advance of the heads by wind blown sparks or bits of burning material. Spot fires are capable of creating a dangerous situation. A number of spot fires may merge and create a new head in advance of the main fire. Men and equipment may be trapped between these fires, and large losses may result. A well organized patrol must be constantly on the alert to locate spot fires and get them under control before extensive damage results.

PARTS/TERMS USED WITH NATURAL COVER FIRES

Fire Line

The perimeter, or fire line, is the hottest part of the fire. However,

PARTS/TERMS USED WITH NATURAL COVER FIRES

Fire Line

The perimeter, or fire line, is the hottest part of the fire. However, natural cover fires are best controlled along the fire line.

Fire Head

The point where the fire is progressing the fastest. A natural cover fire may have several heads, depending on the type, abundance and location of fuel. Fire heads generally travel with the wind.

Fire Tail

The upwind portion of the fire. This is the point where the progress of the fire is usually near the origin.

Fire Flank

All portions of the fire line between the head and tail are called flanks. The burning section between the heads is also called the flank.

Fire Area

The burned out area within the perimeter of the head, tail and flank of a natural cover fire.

Running Fire

This fire moves with the wind, and the rate of burning depends on the velocity of the wind, type and abundance of fuel, and the general pattern or contour of the surface. The head of the fire travels at a rate proportional to the wind velocity. Wind carries additional oxygen to the fire and increases the rate of burning. Fire heads move faster uphill and through draws or canyons than on level ground or downhill; other conditions remaining equal. A running fire should never be controlled from the uphill direction. This involves a high risk to men and equipment. The correct point to begin control is at the tail on the upwind side of the fire line or at the head of the fire when it tops a crest or starts its downhill burning.

Fire Breaks

Fire breaks are cleared areas. Natural fire breaks are lakes, rivers, creeks or bare rock formations. Other fire breaks are roads, survey lines, transmission lines, or cleared areas. Fire breaks should be twice as wide as the height of the material in the area where the fire break is to be constructed. For example; trees that are 50 feet high will require a fire break 100 feet wide. Fire breaks must be cleared of brush and grass to prevent fire from traveling through these flash fuels.

Backfiring

Backfires are employed to burn back toward the advancing head, thus creating a fast fire break and stopping the fire because of a lack of fuel. Backfires are normally used where a suitable network of fire breaks already exist. However, improper backfiring can cause loss of control of the fire and may trap personnel working on the line. Backfiring should not be attempted except on the orders of the person in charge of the operation, who is fully aware of existing conditions. In a backfire, small areas are burned under controlled conditions in advance of the major fire. This eliminates fuel that the fire must have to continue spreading. Thus, when the fire reaches the point where you have backfired, a fire break has been established. Backfiring should not be attempted except under conditions which will assure that they will not get out of control. Improper backfiring causes loss of control of the fire and may trap personnel working in the area. The whereabouts of all men and equipment must be known at all times before any backfiring is started. Before a backfire is started, sufficient men and equipment must be on the job to control the resultant fire. Wind directions and speed must be considered in conjunction with the natural or artificial fire breaks in the area. Whenever possible, the backfire should move directly toward the advancing head of the original fire. At this point, the main fire will be halted. Great damage and loss of lives and equipment may result when backfires are improperly executed.

Artificial Barriers

Artificial fire barriers consist of roads, highways, survey lines, power lines, or any other manmade barriers that will impede the progress of the fire. Specific lines may be cut for preventing the spread of fires previous to the time of outbreak. Fire breaks, those manmade obstacles formed to stop the spread of a fire in a certain area, the time of the fire, must be at least twice as wide as the height of the surrounding natural cover fuels in the area to prevent falling materials from igniting fuels on the other side. These fire breaks should be cleared to conform as nearly as possible with the ridge lines and to connect all natural and artificial fire barriers, thus forming one continuous obstruction to the progress of the fire. One of the most effective barriers to the spread of a natural cover fire that you can create in a very short time and with limited equipment is the backfire.

Natural Barriers

Natural fire barriers consist of lakes, rivers, creeks, deserts, rock formations, and bare ground area. These natural barriers will halt a natural cover fire that burns up to them. Your job then is to control the fire and force it to burn into such areas. This is normally done by the use of artificial barriers and fire breaks.

PIONEER TOOLS

The tools normally used to fight natural cover fires are pioneer handtools. They include chopping tools, scraping tools, and digging tools.

Chopping Tools

Chopping tools are most commonly used by forest firefighters for general chopping work.

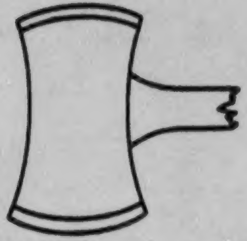


Figure 7. Double Bit Axe.

Double Bit Axe

The edge of one bit may be kept relatively sharp for smooth cutting, while the other bit may be used for chopping roots or material on the ground. See figure 7.

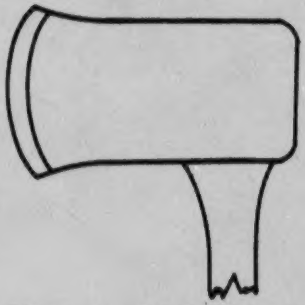


Figure 8. Single Bit Axe.

Single Bit Axe

The single bit axe, figure 8, is particularly useful in mop-up work, where the head serves well in knocking stumps, logs, and other heavy fuels apart. In the hands of unskilled men, the axes, regardless of the type, must be used with utmost care to insure maximum safety.

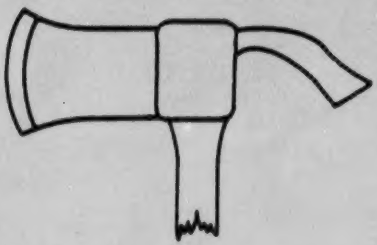


Figure 9. Pulaski Tool.

Pulaski Tool

This is actually a combination tool, which has features of both the axe and the mattock, and is thus suitable for cutting and digging, figure 9. The tool is excellent for cutting small trees. This is a well-balanced tool using a regular double bit axe handle.

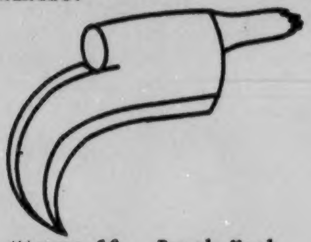


Figure 10. Brush Hook.

Brush Hook

This is a good tool, figure 10, for cutting small trees, brush, heavy weed growth, etc. When necessary, it can be used for chopping heavy material, but an axe is preferred for this type work. This type brush hook is sharpened on the inside of the curved portion and along the continuing adjacent straight edge. Usually the point is left unsharpened as a safety precaution.

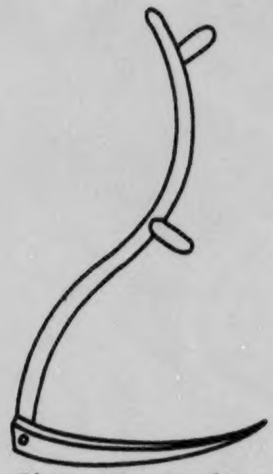


Figure 11. Scythe.

Scythes

The scythe, as shown in figure 11, is used for cutting grass, weeds, grains, etc. Only the inside curved portion of the blade is sharpened. Maximum safety precautions must be exercised when using this tool.

Scraping Tools

These tools are used primarily for moving and scraping light fuels directly on the ground.

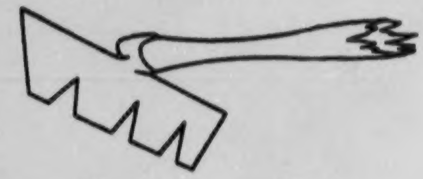


Figure 12. Brush Rake.

Brush Rake

This tool, shown in figure 12, is especially adapted to fire line raking and curring in light brush. The tool weights about four pounds. Other types have a scraping blade made on the top of the rake similar to the McLeod Tool.

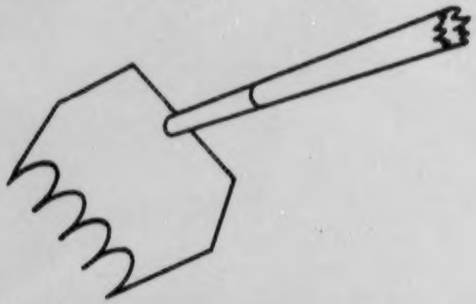


Figure 13. McLeod Tool.

McLeod Tool

This tool is a combination heavy duty rake and hoe, designed for cutting matted brush and heavy grass and for general rake work in medium cover. See figure 13. It is best suited to soil conditions where rocks and small shrubs, such as huckleberry, are not too abundant. The tool is about 11" wide and is equipped with a 48" handle.

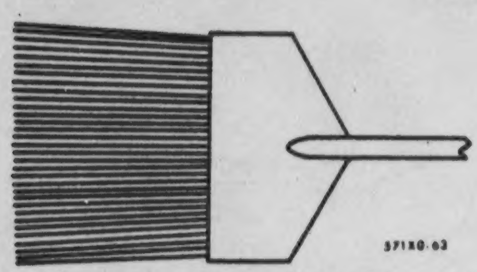


Figure 14. Leak or Broom Rake.

Leaf or Broom Rake

Various types of leaf or broom rakes are used in fire line construction. Brooms are used to move light fuels such as hardwood leaves, where little grass or brush is involved. Figure 14 shows one type of metal broom for heavy duty sweeping or beating out fires.

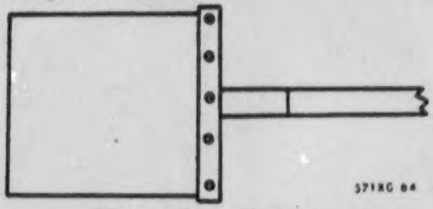


Figure 15. Beater.

Beater

Beaters (figure 15) are used mainly in fire suppression, working best in light grass or grain fields. The beater ordinarily is laid on the fire edge and moves progressively along the line. Hard swatting, especially in a vertical manner, should be avoided as this tends to spread the fire.

Digging Tools

These tools are used primarily to get below the surface of the ground.

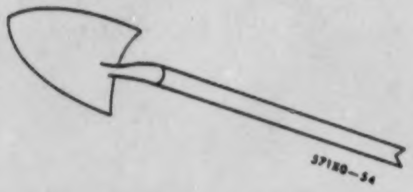


Figure 16. Shovel.

Shovel

Figure 16 shows the long handle, round-point shovel that is most commonly used for suppression work. It is quite common to sharpen one edge and sometimes both edges of the blade to make the shovel function better as a scraping tool in creating a clean fire break.

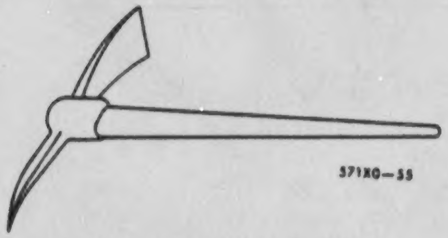


Figure 17. Pick Mattock.

Pick Mattocks

The mattock, figure 17, is used for digging. The wide blade is useful in loose soil, while the pick may be used in rocky or exceptionally hard soil.

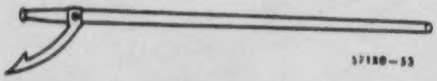


Figure 18. Peavey or Cant Tool.

Peavey or Cant Hook

Peavies or cant hooks are used for turning and moving large logs, figure 18.

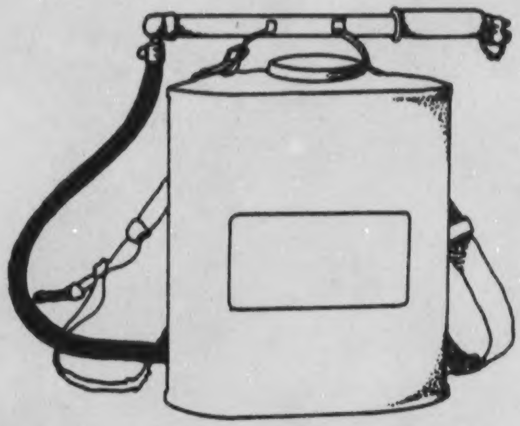


Figure 19. Back Pack Water Extinguisher.

SPECIAL EQUIPMENT

Back-Pack Extinguishers

This extinguisher is designed for brush and grass fires and other special uses, figure 19. The tank is carried on the back of the operator. The extinguisher has a trombone-type pump at the end of the discharge hose. It is operated by moving the sleeve on the pump back and forth. The capacity is five gallons, with water as the extinguishing agent. The operator can spray a stream of water 30 to 40 feet.

Portable Pumps

These are pumps that can be carried by two or four men and set up at a source of water so that water can be pumped directly to the fire through hose lines. There are two general classes of portable pumps, some powered by a two-cycle, and some by a four-cycle engine. Generally, they are single-stage centrifugal pumps.

Hose

Hose used in natural cover firefighting comes in two sizes. These sizes are 1" and 1-1/2" and are used in conjunctiion with the portable pumps.

Mechanized Heavy Equipment

Heavy equipment, such as plows, drags, graders, bulldozers, and trenches are used primarily to clear wide strips of bare soil in the path of an oncoming fire. Use of these large mechanized pieces of equipment surpasses all other methods of fire line and fire break construction in heavy forest fires. However, they require costly equipment to move them to a desired location, and in many cases, unless improved roads are available, they cannot be brought into use at all.

530B and the A/S32P-8 Firefighting Vehicle

When the Air Force becomes involved in fighting natural cover fires, whether on base or for mutual aid in the surrounding community, we use the 530B and the A/S32P-8 pumpers. The 530B pumper has a 6 X 6 (six wheels on the ground and six wheels drive) military chassis. It holds 400 gallons of water and can easily be equipped with handtools.

The A/S32P-8 pumper has a 4 X 4 chassis; it carries 600 gallons of water and 55 gallons of foam. Both pumpers are very mobile over rough terrain making them very effective for natural cover fires.

Control

Fire control can best be defined as: "Reducing or retarding the rate of burning."

Extinguishment

Dirt (mineral soil) is the most common extinguishing agent because it is the most abundant agent where you may be fighting fire. Extinguishment is the complete elimination of the fire.

METHODS OF FIGHTING NATURAL COVER FIRES

Sectional Method

The sectional method of firefighting is best used against a slow moving natural cover fire. In the sectional method, a unit of men is placed in a specific section of the fire line. A unit of men thus placed has full responsibility for all firefighting efforts in that section. Its mission is to stop the forward progress of the fire, extinguish it at the fire line, perform mop-up operations, and execute any other action necessary to assure complete control of the fire.

One Lick Method of Firefighting

In the one lick method of natural cover firefighting, a unit of men is placed on the fire line and work in a specific direction. One or more men in a unit might knock down the hottest portions of the fire with backpack extinguishers, when they are available, and proceed along the flank of the fire. Behind the initial unit, men pass through with axes, mattocks, or other tools; each man taking one "lick" with his specific tool at the fire or at constructing a fire break. For example, the men with axes, who are grouped together, may encounter a small tree directly in the path of the fire. The first man would swing once at the base of the tree and move onward. If the first man fails to completely sever the tree from its base, the second man would strike the tree in the same spot. Severing the tree, the second man would move on. If it is unnecessary for the third man in line to make a stroke or "lick" at that particular point, he would throw the tree from the path of the fire so that it would not become involved in the fire. Behind the axeman would be several men who should be forming a fire break with their tools.

Direct Method of Attack

The direct method of attack is very effective against natural cover fires, but should be attempted only when you are involved with a moderately hot fire. If the fire is extremely hot or very fast running (these two conditions usually go together), close approach to the fire might be impossible and very dangerous. Either the sectional or "one lick" method of personnel organization can be used to attack the fire directly.

You should approach on the flanks of the fire using whatever extinguishing equipment is available to combat the fire. By extinguishing the flanks of the fire, you force the fire to turn away from its natural path of spread in front of the wind. Since the fire is no longer moving directly with the wind, it will start to lose some of its spread and heat. As you continue to turn the fire by extinguishing the flank, eventually the only direction of travel available to the fire is against the wind. At this point, the fire is at such a disadvantage that total extinguishment is relatively easy.

Indirect Method of Attack

The indirect method of attack is effective on all types of fires. It is most effective, however, for use against very hot or fast running fires when close approach to the fire area by firefighting personnel is impractical. This method of natural cover fire control entails the use of fire breaks or barriers, both natural and artificial, to stop the progress of the fire.

Self-Protection (Safety)

When fighting natural cover fires, you must be constantly aware of the dangers present to you. All nonessential personnel in the fire area should be warned of the danger and evacuated. Buildings endangered by the fire should be examined for occupants that need to be evacuated. This will reduce the life hazard for the occupants and for you as well, since you will not then be forced to return later in an attempt to rescue such persons. You should always be on the alert to keep yourself from becoming trapped by the fire. Natural cover fires can move at extremely fast speed. If it appears that you might become trapped by a fire or if you find yourself surrounded by a number of spot fires that are closing in, you should try to find some sort of refuge. Rivers, streams, lakes, fire breaks, and gulleys offer a relatively safe refuge from the heat of an approaching fire. If you are trapped by a fire or if you find yourself ahead of a fast moving fire and no refuge can be found, there is one "last chance" action that you could take. By lying face down on the ground and covering your head with your coat or shirt (wetted if possible) you can escape most of the fire heat. Then, when the head of the fire approaches and the heat becomes too intense, you can try running through the head of the fire to the burned out area behind it. If the vegetation is not too thick or the head of the fire too wide, you stand a good chance of escaping this way. Remember, this is a "last chance" action. You should make every effort to avoid a situation that would call for such action. One of the most important self-protection thoughts to keep in mind when fighting a natural cover fire is your location in relation to fire travel. As an example, never attack a natural cover fire when approach necessitates travel in a draw, valley, or canyon. If the fire cannot be stopped or if the wind direction and speed were to change, you could very quickly find yourselves facing an approaching fire head with no place to go.

Patrol and Mop-Up

Once the fire in one sector is under control, you should make provisions to prevent the fire from jumping the fire line or reigniting. To do this we place men at intervals along the fire line. Then we equip them with shovels, backpack extinguishers and other available equipment to protect the area and assure that the fire will remain under control. Such a group of firefighters on patrol can cover an area for several hundred yards outside the fire line, searching for spot fires and extinguishing them promptly upon detection. If the spot fire is large or cannot be controlled, help should be summoned before a conflagration evolves. When the entire fire line is under control and all progress of fire heads is stopped, mopping-up procedures should be started. These include the extinguishment of every spark or ember in the fire area, because burning embers, smoking logs, or burned foliage may flare up with the first gust of wind. Mop-up is best accomplished by working one strip or band of the area at a time. A band extending a certain distance inside the fire line is mopped-up first. Then, other bands of specified widths are covered successively until the entire burned area has been covered and the last spark put out.

QUESTIONS

Answer these questions on a separate sheet of paper which will be given to your instructor for correction and evaluation. Do not write in this book.

1. The four types of natural cover fires are ______________ fires, ______________ fires, ______________ fires, and ______________ fires.

2. The fire __________ is the point where the fire is __________ the fastest.

3. The point where the fire is usually near the origin is called the __________ ______________.

4. All portions of fire between the __________ and tail are called the ______________.

5. If the tallest timber is 100 feet, the fire break should be __________ feet wide.

6. Rivers, lakes, creeks, and bare ground are called __________ barriers.

7. Roads, highways, and manmade barriers are called __________ barriers.

8. The different methods of fighting a natural cover fire are called the __________ method, __________ __________ method, ______________ method, and ______________ method.

9. The method to use on a very hot or fast running fire using fire barriers is called the __________ ______________ attack.

10. The __________ __________ is best used against a slow moving natural cover fire.

11. If a unit of men is placed on the fire line and work in a specific direction this is called the __________ ______________ method.

12. If you have turned the direction of __________ of the fire so the only travel available is against the wind, then you have used the ______________ method of attack.

13. Fire control can best be defined as __________ or ______________ the rate of burning.

14. Tools normally used to combat natural cover fires are called ______________________.

REFERENCE

1. AFR 92-1, Fire Protection Program.

Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-SG-108

MISCELLANEOUS FIREFIGHTING

OBJECTIVES

After completing this study guide and your classroom instructions, you will be able to:

1. Identify principles involved in miscellaneous firefighting.

2. Identify the principles involved in various methods of controlling and extinguishing miscellaneous fires.

3. Identify principles related to the tools and equipment used in miscellaneous firefighting.

INTRODUCTION

TYPES OF MISCELLANEOUS FIRES

Sanitary Land Fill Fires

There are basically two types of land fill fires which are municipal dumps and land fill areas. Municipal dumps are for disposal of class "A" combustible materials only where burning is allowed under controlled or ideal conditions. Land fill areas are for land fill purposes only. Class "A" materials are the only type of materials disposed of in this area and burning is not allowed. This is the best method of disposal because there is no burning and there will be no pollution involved.

Control and extinguishment of sanitary land fill fires will be by the use of fire breaks or barriers. The most common extinguishing agent will be water or water fog and the secondary agent will be earth.

Dumpster Fires

Dumpsters are located in access areas around buildings. They are for limited storage of class "A" materials only. There is no burning allowed, but if a fire should occur it should be extinguished with water in the form of a water fog stream or a total saturation of the dumpster.

Vehicle Fires

Almost all vehicle fires originate on two systems, the fuel system and the electrical system. The main hazard in fighting a fire involving the fuel system would be an explosion. You would extinguish this type of fire with carbon dioxide (CO_2), foam or dry chemical. When combating a fire involving the electrical system, your main hazard would be the possibility of shock. When fighting this type of fire, you would want to select an agent which would not conduct electricity. The only type of agents you could use would be carbon dioxide, or dry chemical. You should also guard against explosion of the gas tank due to expanding vapors by cooling the gas tank with water.

Electrical Fires

There are two types of electrical fires which we will be concerned with, these are motors/generators and transformers. You have two main hazards involved in this type of fire. They are shock and explosion. You will again want to select an agent that will not conduct electricity. There are only two types of nonconductive agents, these are carbon dioxide and dry chemical. You may also use a straight stream of water applied in a whipping motion to extinguish these types of fire.

Agricultural Fires

Agricultural fires are fires which involve grain fields, grain storage, or hay storage. In grain storage, type of fire, we will be mainly concerned with the hazard of explosion. We can combat this type of fire by using the direct or indirect method of firefighting. Our primary extinguishing agent will be water and the secondary will be earth.

TOOLS AND EQUIPMENT

There are many tools you will be concerned with in miscellaneous type firefighting. The proper care and maintenance of tools is an important safety factor to the individual using it as well as to the personel working around him. The individual who is using the tool has the responsibility of the proper maintenance and upkeep for the tool he is using at that time. IT IS NOT THE RESPONSIBILITY OF THE CREW CHIEF. Here is a list of the tools which you will be using to fight miscellaneous fires; and their proper uses.

Axes

There are two types of axes which you will be using. They are the single bit axe and the double bit axe. The double bit axe has two edges, one is kept sharp for cutting and the other edge is kept dull for chopping. The single bit axe is used for chopping purposes only. When using an axe, a constant awareness of safety by the user should be practiced at all times.

Shovel

The shovel is a handtool which is used to apply the secondary extinguishging agent, earth, to a miscellaneous type fire.

Spanner Wrench

The spanner wrench is used to shut-off natural gas lines to a burning structure. It is also used to tighten or loosen 2-1/2-inch hose couplings and for prying doors and windows.

Pike Poles

The pike is used to separate burning materials or pull unburned materials from a fire area. Example would be to separate hay during a hay stack fire.

Rakes

We have two types of rakes which are the fire rake or the leaf or broom rake. Rakes are basically used to clear fire breaks of light materials.

Bolt Cutters

Bolt cutters are a firefighting handtool used to make forcible entry or remove obstacles which might stop firefighters from performing suppression tactics. It is particularly fast and effective in cutting locks, bolts, tubing, and certain size wires and cables.

Claw Tool/Crow Bar and Door Opener

These are tools which are used for forcible entry into locked or jammed doors and windows. Primary use of these tools is prying.

SUMMARY

Miscellaneous firefighting have no set procedures and cannot be prefire planned to give firefighters an idea of how to fight or combat fires of this nature. The senior firefighter on the scene at the time of a miscellaneous fire sets up procedures according to the class and nature of the fire.

QUESTIONS

Answer these questions on a separate sheet of paper which will be given to your instructor for correction and evaluation. Do not write in this book.

1. You will follow __________ __________ procedures in combating __________ fires, according to __________ and __________ of fire.

2. __________ fires are fires of __________ types that cannot be __________ planned.

3. Upon arrival it takes __________ __________ and __________ on the senior firefighters part to safely attack and __________ fires of this nature.

4. There are basically __________ types of land fill fires, which are ______________ _________________ and ________________ ________________.

5. ______________ ________________ is the most satisfactory method of disposal because there is no _______________ so there is no ______________ involved.

6. _____________ and _______________ of sanitary land fill fires will be by the use of ______________ and __________________.

7. Dumpsters are located in ________________ __________________ around buildings. They are for __________________ ____________________ of class ____________________ materials.

8. Most vehicle fires ____________ in two ______________ which are the ______________ and _______________.

9. In electrical fires, you have _____________ main types. They are ________________ and ___________________

10. Agricultural fires are fires which involve _____________ _____________, _________ storage or _____________ _________ _________. With this type of fire we will be ____________ __________ with the ______________ of __________________.

11. The ______________ who is using the _____________ has the _______________ for the proper ___________ and _________________ for the tool he is using.

12. The ____________ is an _____________ which is used to apply the extinguishiing agent, that is ________________ to a ________________ type fire.

13. In summarizing, ______________ firefighting has no ___________ procedure and is no _______________ ________________ to give firefighters an idea of how to __________ or ________________ fires of this ________________.

REFERENCE

1. AFR 92-1, Fire Protection Program.

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MODIFICATIONS

Pages 31-62 of this publication has (have) been deleted in adapting this material for inclusion in the "Trial Implementation of a Model System to Provide Military Curriculum Materials for Use in Vocational and Technical Education." Deleted material involves extensive use of military forms, procedures, systems, etc. and was not considered appropriate for use in vocational and technical education.

Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-SG-110

OPERATION AND SERVICING OF PORTABLE EXTINGUISHERS

OBJECTIVES

After completing this study guide and your classroom instructions, you will be able to:

1. Inspect a portable fire extinguisher.
2. Identify procedures for repairing or replacing parts on extinguishers.
3. Recharge extinguishers using workbook checklist.
4. Perform an operational test on extinguishers by completely extinguishing a fire.

INTRODUCTION

Fire extinguishers are portable, hand-operated appliances having a limited capacity. They are provided for emergency use to control or extinguish a fire in its beginning or incipient stages. The proper use of these extinguishers on the early stages of a fire can prevent the loss of life and excessive property damage. Of course, these extinguishers must be in a location tht is readily available and they must be capable of extinguishing the fire.

INFORMATION

TYPES OF EXTINGUISHERS

The fire protection organization is responsibile for inspection and maintenance of fire extinguishers. Each type of extinguisher is of value but no one type is equally effective on all classes of fire. The types widely used in the Air Force today will be covered in thic study guide. They are:

1. Water (pressurized).
2. Foam.
3. Carbon dioxide (CO_2).
4. Dry Chemical.

Pressurized Water Extinguishers, Figure 32

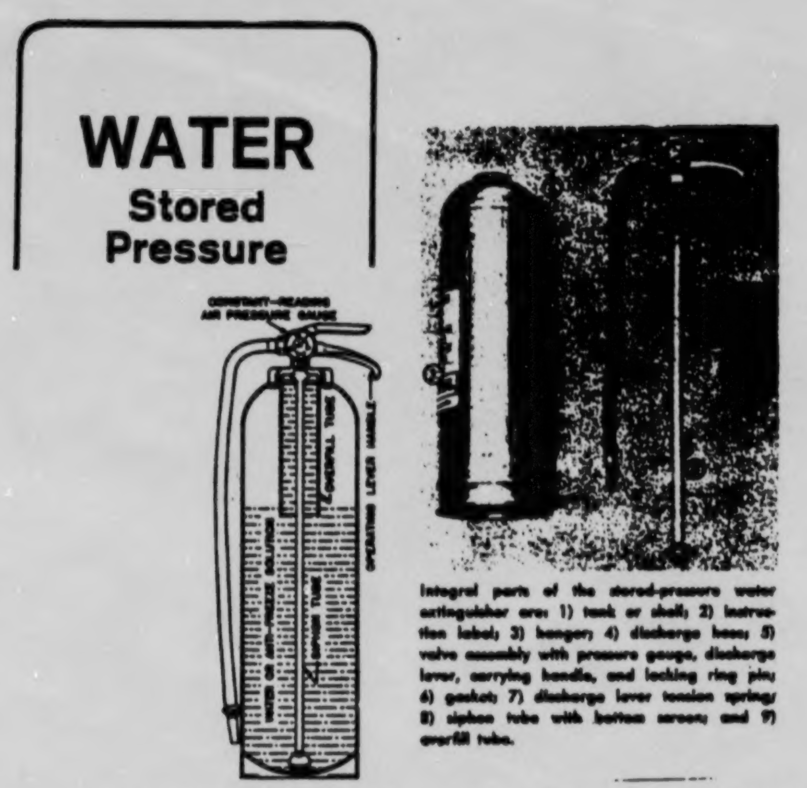
In the Air Force today, the pressurized water extinguisher is fast becoming the rule instead of the exception. Today, the 2-1/2 gallon pressurized water extinguisher has practically replaced all other sizes previously used.

The pressurized water extinguisher will discharge water 30 to 40 feet for effective use on class "A" fires only. The forces used to expel the water are either 100 psi of stored air pressure or 100 psi of dry nitrogen.

INSPECTION AND MAINTENANCE PROCEDURES. Monthly inspection of the pressurized water requires a complete visual check of the outside of the extinguisher. The pressure gage should read 100 psi without any physical damage. The pin and seal should be intact and secured around the discharge lever. The hose and nozzle assembly should be free of obstructions, cracks, and/or dry rot. The outer container or tank should be free of rust, cracks in seams or dents. The instruction plate, head and nozzle holder must be the designated parts for the particular extinguisher and the hangar assembly intact.

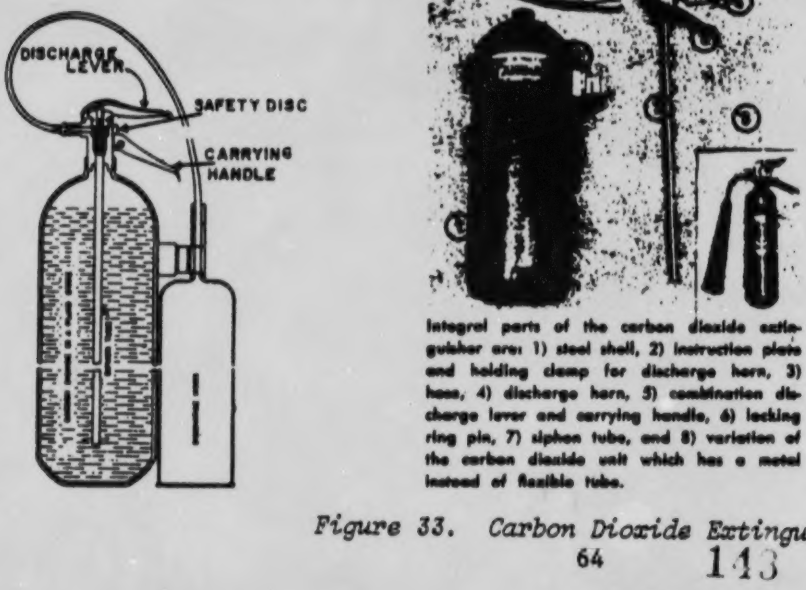
Annual inspections require the same visual check as the monthly inspection including an operational check which means discharging the contents under pressure. Once the discharge is complete the extinguisher must be cleaned, refilled, recharged and replaced to the desired location with a new copper wire and lead seal around the discharge lever.

WINTERIZATION. When the pressurized water extinguisher is exposed to extremely


WATER
Stored
Pressure
CONSTANT-READING
AIR PRESSURE GAUGE

Integral parts of the stored-pressure water extinguisher are: 1) tank or shell; 2) instruction label; 3) hanger; 4) discharge hose; 5) valve assembly with pressure gauge, discharge lever, carrying handle, and locking ring pin; 6) gasket; 7) discharge lever tension spring; 8) siphon tube with bottom screen; and 9) overfill tube.

Figure 32. Water Stored Pressure Extinguisher.


COMPRESSED
GAS
Carbon Dioxide
DISCHARGE
LEVER
SAFETY DISC
CARRYING
HANDLE

Integral parts of the carbon dioxide extinguisher are: 1) steel shell, 2) instruction plate and holding clamp for discharge horn, 3) hose, 4) discharge horn, 5) combination discharge lever and carrying handle, 6) locking ring pin, 7) siphon tube, and 8) variation of the carbon dioxide unit which has a metal instead of flexible tube.

Figure 33. Carbon Dioxide Extinguisher.

cold temperatures, an anti-freeze agent is needed. Kaloy is the liquid agent used to prevent the water from freezing at temperatures between 32° to 0°F. Temperatures below 0°F, Kaloy is added with dry nitrogen as the expelling pressure.

Carbon Dixode (CO_2), Figure 33

The CO_2 extinguishers found in the Air Force range from 2 pounds to 100 pounds with 15 and 50 pound sizes being the most common. The 15 pound is a portable type hand extinguisher, with the 50 pound being a wheel type. The extinguisher consists of a seamless steel cylinder containing liquified carbon dioxide. At room temperature, carbon dioxide exerts a pressure of 800 to 875 psi in the extinguisher. This internal pressure expels the liquid carbon dioxide which turns to a vapor when it comes in contact with air. Special consideration must be given to the effective range of these extinguishers, because it is only three to eight feet (which is relatively short compared with other portable fire extinguishers). This extinguisher will be used on class "B" fires and "C" fires because carbon dioxide does not conduct electricity.

> Caution: Because of the -110°F temperature when discharging this extinguisher, special consideration must be given to operating procedures, or frostbite may occur. When used in confined spaces, asphyxiation could occur.

INSPECTION AND MAINTENANCE PROCEDURES. Monthly inspection of the carbon dioxide extinguishers should include checking the wire and lead seal to insure that the seal is intact and the plastic seal to ascertain that the seal is in place on the pressure release disk, also check the extinguisher's location to insure that it is not subject to high temperatures or in the direct rays of the sun and the hose for deterioration or weakness, and the horn for damage. If the wire and lead seal or the plastic seal is missing, weight, recharge (if necessary) and reseal the extinguisher.

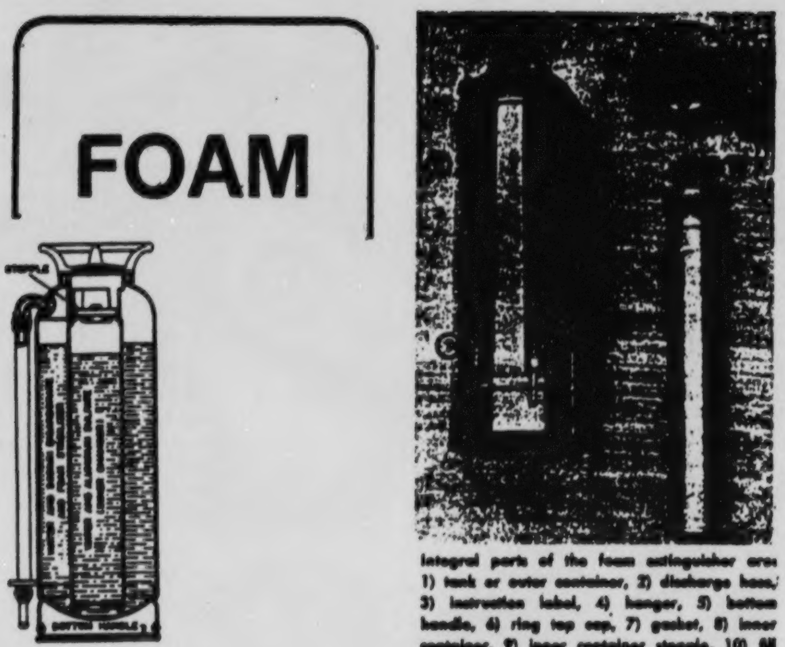
Annual inspection of the carbon dioxide extinguisher should include a complete visual inspection and weighing of the extinguisher to insure a full charge. An extinguisher should be recharged if it falls below 10% of its rated capacity.

CHARGING PROCEDURES. Carbon dioxide extinguishers may be charged by commercial charging plans, transfer pumps, bypass filling units, or dry ice converters. The extinguishers should be recharged after use, and when they fall below 10% of their rated weight capacity. Recharging must be done only by qualified personnel. Extremely high pressures are encountered and every care must be taken to insure secure connections, adequate valves, and safe practices. For additional information regarding charging of carbon dioxide extinguishers, read AFR 92-1.

WINTERIZATION PROCEDURES. Carbon dioxide extinguishers do not normally require winterization. The extinguishers, however, are subject to a reduction in pressure when the temperature drops. All carbon dioxide extinguishers to be operated at temperatures below 0°F and all airborne carbon dioxide fire extinguishing cylinders should be winterized by adding 200 psi dry nitrogen to the carbon dioxide. With the addition of dry nitrogen, the extinguisher is serviced to operate through the temperature range of minus 65°F to plus 160°F. Dry nitrogen is not affected by heat and cold as is carbon dioxide and it provides additional pressure for expelling carbon dioxide in the cylinder. The cylinder safety disk will not blow out below 160°F; thus, the extinguisher will operate at high temperatures without danger of cylinder discharge. Dry nitrogen should be added to the cylinder being charged for extreme temperature operation (regardless of size) until the pressure is 200 psi at 70°F or corresponding pressures for other temperatures.

Foam Extinguisher (2-1/2 Gallons), Figure 34

The foam extinguisher is used on class "B" fires. The 2-1/2 gallon foam extinguisher has an outer chamber consisting of a solution of sodium bicarbonate mixed with water and an inner chamber containing aluminum sulfate



Integral parts of the foam extinguisher are: 1) tank or outer container, 2) discharge hose, 3) instruction label, 4) hanger, 5) bottom handle, 6) ring top cap, 7) gasket, 8) inner container, 9) inner container stopple, 10) fill level of water and sodium bicarbonate solution, and 11) fill mark of water and aluminum-sulfate solution.

Figure 34. Foam Extinguisher.

mixed with water. To operate this extinguisher it must be inverted, allowing the contents of these two chamber to mix. This mixing causes a chemical reaction, forming a carbon dioxide gas which is the expelling force and discharges the agent 30 to 40 feet. A lead stopper seated on the inner chamber prevents the normal mixing of these two chemicals. Caution should be taken when using this extinguisher as foam is a conductor of electricity.

MONTHLY INSPECTION. This includes checking the nozzle for stoppage, the hose for damage or deterioration, and the tank for any signs of weakness or damage. At this point, one should keep in mind that the mixing of these chemicals forms pressure, and any damage to the tank itself would cause a dangerous situation; that being the possibility of the tank itself rupturing.

SEMIANNUAL INSPECTION. This consists of all the procedures listed in the monthly inspection plus removing the threaded ring cap and inspecting the quantity and quality of the chemicals in both chambers. At this time, be sure to check the lead stopple on the inner chamber for freedom of movement and also insure that the sealing gasket is not worn or damaged in any way, therefore, you would be making a complete check of internal parts, replacing if necessary.

ANNUAL INSPECTION. This consists of a complete visual and operational check, replacement of defective and damaged parts and reservicing the extinguisher.

CHARGING PROCEDURES. The foam extinguisher will be charged in accordance with the manufacturer's specifications. The chemical contents will come in two separate packages marked "A" which is aluminum sulfate for the inner chamber, and "B" which is sodium bicarbonate for the outer chamber. Both chemicals will be mixed separately in clean containers. Package "A" will be mixed with 2-1/2

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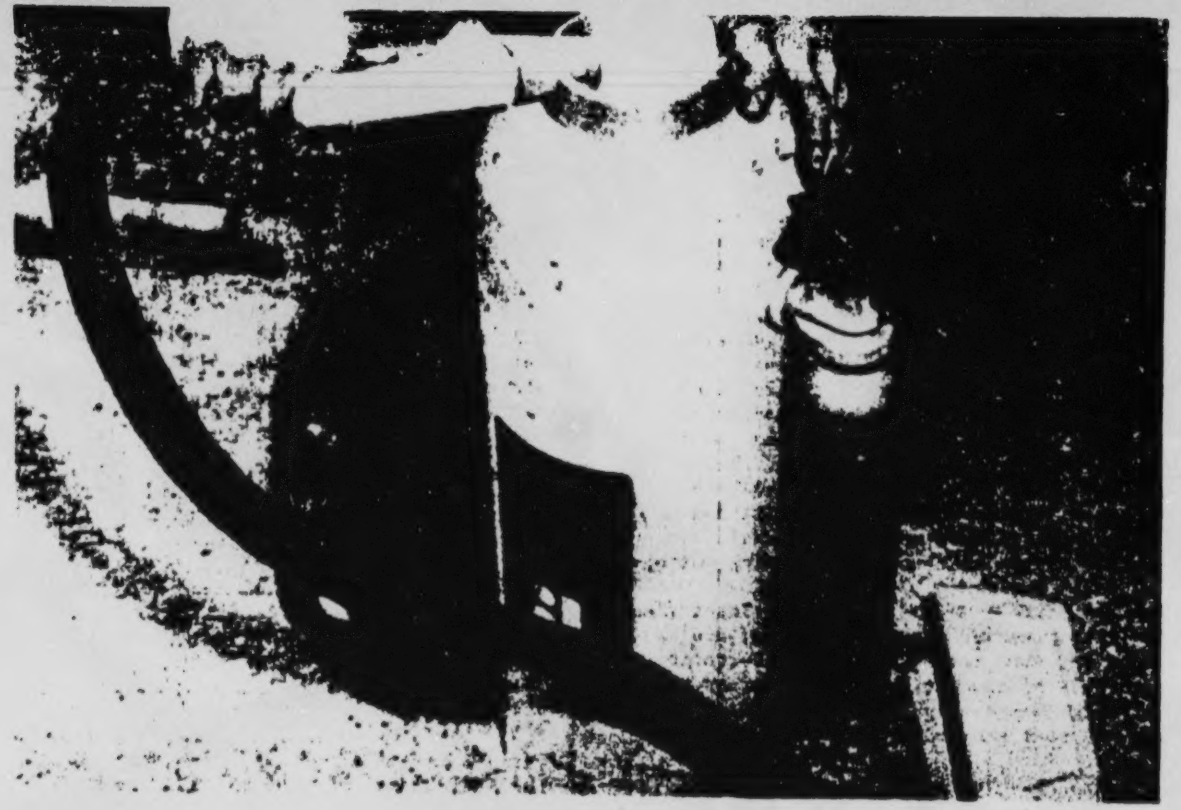

Figure 35. Dry Chemical Extinguisher.

pints of hot water (approximately 150°F) and package "B" with 1-3/4 gallons of warm water (approximately 110°F). Mixing of these chemicals at temperatures hotter than those recommended will cause a breakdown rendering them ineffective. Upon completion, the lead stopple will be replaced, the gasket checked, and the ring cap secured in place.

WINTERIZATION. Winterization of this extinguisher is not possible as the addition of any anitfreeze solution will break down the chemicals, causing them to become ineffective. This extinguisher will be placed in heated areas where there is no possibility of freezing.

Dry Chemical Extinguisher

Dry chemical extinguishers comes in sizes of 2-1/2 to 30 pounds. This extinguisher will be used on B&C fires. Discharge reach under normal conditions will be from five to 20 feet. Discharge time under normal conditions is 10 to 25 seconds. Figure 35 shows a dry chemical extinguisher.

OPERATING PRINCIPLE. The chemical compound in dry chemical extinguishers consists principally of sodium bicarbonate or potassium bicarbonate, which has been chemically processed to make it moisture resistant and free-flowing. This compound is discharged under pressure and directed at the fire.

The extinguisher may contain a cartridge of carbon dioxide or nitrogen gas, either inside or alongside the main container to expel the dry chemical. When the pressure is allowed to enter the main cylinder, the dry chemical may be expelled upon opening the shut-off nozzle. Some extinguishers are pressurized with inert gas or DRY air and do not have cartridges.

METHOD OF OPERATION. These extinguishers are designed to be carried to the fire and, to be used, must be operated in accordance with instructions which are prominent on the extinguisher. In the case of cartridge-operated extinguishers, release of the gas in the cartridge pressurized the dry chemical chamber and expels the dry chemical. The discharge is controlled by a shutoff valve. With a pressurized dry chemical extinguisher, both the dry chemical and expellant are stored in a single chamber and the dry chemical may be expelled by opening the extinguisher valve. Release of the extinguisher valve provides a shutoff feature. In either case, operation expels a cloud of dry chemical from the nozzles. On fires in flammable liquids, the discharge should be directed at the base of the flames. Best results are obtained by attacking the near edge of the fire and progressing forward moving the nozzle rapidly with a side-to-side sweeping motion.

INSPECTION AND MAINTENANCE. Inspection includes checking the hose, nozzle, and container for cracks, leaks, and corrosion; tightness of connections between pressure cartridge and extinguisher; and that the pin and seal are holding valve in position.

ANNUAL. The annual inspection will include a complete check and operational test of the extinguisher. Remove spent pressure cartridge. Remove cap from extinguisher, check extinguisher for damage. If not damaged, start recharging procedures. Refill container with the proper amount of dry chemical agent. Replace cap tighten cap. Replace pressure cartridge with one that is sealed and has the proper weight. If cartridge is 1/2 ounce below weight stamped on container, select another cartridge. Place pin and nozzle in proper place and seal.

QUESTIONS

Answer these questions on a separate sheet of paper which will be given to your instructor for correction and evaluation. Do not write in this book.

1. The ____________ ____________ ____________ is responsible for inspection and ____________ of fire extinguishers.

2. Fire extinguishers are portable, hand-operated appliances having a ____________ capacity and are used on fires in its ____________ stage.

3. The most common water extinguisher is of what type?

____

4. On the monthly inspection, the pressure in the water extinguisher should be ____________ psi.

5. In extremely cold temperatures, the pressurized water extinguisher is winterization with ____________.

6. CO_2 extinguishers should be recharged if they fall below ______ % of their rated capacity.

7. A CO_2 extinguisher is winterized by adding ________ psi of ____________ ____________.

8. To operate the foam extinguisher, it must be ____________.

9. During the ____________ inspection, the foam extinguisher must have a complete visual and ____________ check.

10. During the semiannual inspection of the foam extinguisher be sure to ________ the ____________ ____________ for ____________ of movements.

11. Winterization of the ____________ extinguisher is not possible as the antifreeze solution will ____________ down the ____________ causing them to become ineffective.

12. Dry chemical extinguishers come in sizes of - ______ to ______ pounds.

REFERENCE

1. AFR 92-1, Fire Protection Program.

MODIFICATIONS

Pages 69-72 of this publication has (have) been deleted in adapting this material for inclusion in the "Trial Implementation of a Model System to Provide Military Curriculum Materials for Use in Vocational and Technical Education." Deleted material involves extensive use of military forms, procedures, systems, etc. and was not considered appropriate for use in vocational and technical education.

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PROTECTIVE CLOTHING

OBJECTIVES

After completing this study guide and your classroom instructions, you will be able to:

1. Identify, inspect and maintain protective clothing.
2. Don protective clothing within two minutes.

INTRODUCTION

In order to fight fires and perform rescue efficiently and with maximum safety, the Air Force fire protection organization issues two types of protective suits. They are the structural protective suit used for protection against normal exposure to heat, flames, water, cold weather, and physical injury and the aluminized special heat reflective suit used for protection against excessive radiated heat and flames, resulting from aircraft, structural, missile and training fires. The special protective clothing further offers protective from alpha and beta radiation, however, does not offer any protection from gamma radiation.

INFORMATION

All types of protective clothing are generally intended to be worn, in various combiantions, over and in conjunction with normal personal work clothing. This will depend upon specific climatic work and fire conditions.

STRUCTURAL PROTECTIVE CLOTHING

Protective Coat

This is a 3/4 length coat of special water repellant, flame retardant, duck outer cloth, with water repellent liner and removable inner liner. Special snap fastener are provided to enable quick hitch securing of the coat in place.

Protective Trousers

These consist of an overtrouser of duck cloth and liner, similar to the protective coat. The trouser legs are designed for rapid donning and to be worn over firemen's boots. Special waist flap and snap fastenings are provided to facilitate securing in place. Trousers are generally worn with heavy duty quick hitch suspenders. When not being worn, protective trousers are normally assembled over boots with suspenders arranged to permit donning in a single movement.

Suspenders

These are standard fire service suspenders.

Structural Helmet

This is a special moulded plastic safety helmet with cushioned headstrap to provide fit and prevent impact head injury. A chin strap is also provided to further secure the helmet in place under hazardous work conditions. In some cases, an additional removable inner liner with ear and back of neck flaps is provided. This helmet protects falling debris, contact with obstructions and to some degree against water and moderate heat reflection.

Boots

Knee high rubber boots will be made with steel arches and steel toe protection to safeguard the feet of firemen engaged in any type of firefighting activity.

Gloves

Standard gloves consist of conventional leather shells of medium duty type, with wool, cotton or other fabric or

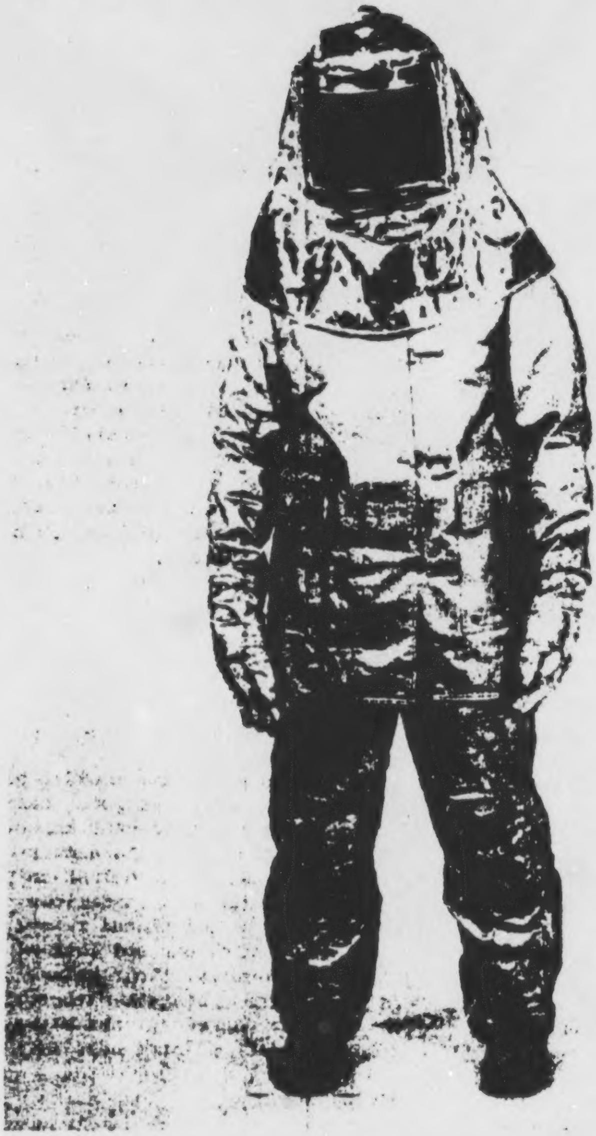

Figure 36. Fireman's Clothing.

other rubber or synthetic coated liner, depending on condition and personal preferences.

SPECIAL HEAT REFLECTIVE CLOTHING
(SEE FIGURE 36)

Crash Hood

The A-1B protective hood has been designed to provide a maximum heat protection while combatting high temperature fires. The hood consists of four major components.

1. Detachable cover of an outer shell of aluminized asbestos, glass cotton cloth with neoprene coated fiberglass interlining and a wool knit inner lining. The cover is attached to the frame by means of six snap fasteners.

2. Frame with attached hat.

3. Thermosettting plastic facepiece.

4. A cellulose acetate facepiece cover.

The fire protection helmet has an adjustable head ban which has a variety of sizes. The frame is attached to and swivels on the helmet in such a manner that the following results are accomplished:

1. The facepiece has been designed to a 180 degree arc curve for maximum vision and clearance for the nose and eyeglasses.

2. The assembled hood can be easily tilted upward to a point where the center of the bottom edge of the frame will be out of line of vision, projected from the eyes at an angle of at least 30 degrees above the horizontal plane, and firmly holds position after being adjusted.

3. The tightness of hinge can be adjusted.

4. All attached and adjusted fittings have sufficient strength and flexibility for their intended purposes.

5. Each helmet has an adjustable chin strap.

Special Heat Reflective Coat

The coat is asbestos and cotton herringbone twill outer cloth with aluminum coating. Flame resistant cotton corduroy collar, snap hook and D ring closure with protective flap. It has cheesecloth quilted lining neoprene rubber coated nylon, taffeta interlining with flameproof materials. The coat is designed for use in high temperature fires.

Special Heat Reflective Trousers

The trousers are made of flame resistant and water repellant treated asbestos and cotton outer cloth. They have aluminized coated outside quilted rayon twill cheesecloth lining, flame resistant neoprene rubber coated interlining. The trousers are designed for use in high temperature fires.

Special Heat Reflective Gloves

Gloves consist of a standard leather palm glove with fabric backing that has been covered with heat reflective surface designed to give the same radiant heat protection as the other aluminized clothing.

Boots

Rubber boots designed particularly for fireman's use are of knee or calf length. Former boots, of conventional style, are being replaced by a newly developed reinforced and insulated calf length boot resembling an aviator's boot, type MA-1. A rubber or synthetic foam and air space construction of sole, upper foot, ankle and lower leg portion of this boot provides both heat and cold insulation and protects the foot against physical injury from falling objects, punctures, abrasions, etc. The boot may be worn with equal comfort in both hot and cold climates with variations in socks.

DONNING PROTECTIVE CLOTHING

Speed in getting into protective clothing is a very important factor in responding to a fire or emergency.

Protective clothing should be so positioned and arranged that it can be put on quickly. A time proven positioning procedure is to attach the suspender to the trousers, put on the boots, put on the trousers, leaving the trouser legs outside the boots. Now, remove the boots and trousers, slide trousers down over tops of the boots, arrange suspenders so they are hanging free and will not interffere when pulling trousers up; step out of the boots. Thus, your protective clothing is naturally positioned for getting into quickly. During the daytime, your boots and trousers should be positioned near your crew position. When you are in bed, they should be positioned at the side of your bed. The gloves should be fastened to or in the protective coat. Your helmet or hood and protective coat should be hung at your position on the fire apparatus.

INSPECTION AND PREVENTIVE MAINTENANCE OF PROTECTIVE CLOTHING

Daily and after every use, check all types of protective clothing for damage from cuts, abrasions, burns or wear. Reflective fabrics of coat and trousers are somewhat more susceptible to cuts and tears especially when working in close proximity to jagged metal such as damaged aircraft. All items of clothing should be "flushed off" with water after use to remove any residue of fuels, extinguishing agents, oils, chemicals, dirt, etc. Persistent dirt or combination should be removed by washing with mild soap. Clothing should be dried thoroughly to prevent molding or rotting.

QUESTIONS

Answer these questions on a separate sheet of paper which will be given to your instructor for correction and evaluation Do not write in this book.

1. The aluminized protective clothing is worn for added protection when combatting excessive ______________ ______________ and ______________ resulting from aircraft crash.

2. All types of protective clothing are intended to be worn in ______________ ______________ and in conjunction with ______________ personnel __________.

3. The protective coat is a __________ length coat of special ______________ ______ ______________.

4. The structural helmet is a special __________ ______________ safety helmet with cushioned ______________ to provide fit and prevent ______________ ______________ injury.

5. The A-1B protective hood consists of __________ ______________ components.

6. The facepiece has a __________ degree arc curve for ______________ ______________ and clearance for the nose and ______________.

7. Protective clothing should be positioned and ______________ that it can be put on ______________.

8. After use, check your protective clothing for ______________ from __________, __________, __________ or ______________.

9. Persistent __________ or contamination should be ______________ by washing with ______________ __________.

10. Clothing should be __________ thoroughly to prevent ______________ or ______________.

REFERENCES

1. AFR 92-1, Fire Protection Program.

2. TO 14P3-1-12, Fireman's Clothing.

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PREPARE THE MAN

WORKBOOK 3ABR57130-1-WB-100

Technical Training

17-2

Fire Protection Specialist

BLOCK I
FIRE PROTECTION OBJECTIVES AND RESPONSIBILITIES

12 August 1975

AIR TRAINING COMMAND

CHANUTE TECHNICAL TRAINING CENTER (ATC)

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Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-WB-110

OPERATION AND SERVICING OF PORTABLE EXTINGUISHERS

OBJECTIVES

Using this workbook and your classroom instruction, you will be able to do the following:

1. Inspect portable fire extinguishers.
2. Recharge portable fire extinguishers.
3. Perform an operational test by extinguishing a fire.

EQUIPMENT

	Basis of Issue
Fire Extinguishers	1/5 students

PROCEDURE

Inspect portable fire extinguishers using the following checklist.

2 1/2 Gallon Foam Extinguisher

Items To Be Checked — Corrective Action

1. Mechanical damage to outer shell
    a. Dents
2. Presence of repairs
    a. Welding
    b. Soldering
3. Damaged threads
    a. Corrosion
    b. Cross thread
    c. Worn
4. Broken hanger attachment
5. Name plate
    a. Loose
    b. Illegible wording
    c. Missing

Items To Be Checked   Corrective Action

6. Hose assembly
    a. Cuts
    b. Blocked
    c. Worn or frayed
7. Inner chamber
    a. Lead stopper
    b. Dents
    c. Cracks

2 1/2 Gallon Pressurized Water Extinguisher

Items To Be Checked   Corrective Action

1. Mechanical damage to shell
    a. Dents
    b. Welding
2. Damaged threads
    a. Corrosion
    b. Worn
    c. Cross threaded
3. Broken hanger attachment
4. Name plate
    a. Loose
    b. Illegible wording
    c. Missing
5. Hose assembly
    a. Cuts
    b. Blocked
    c. Abrasions

Items To Be Checked	Corrective Action

6. Pressure gage
   - a. Dented
   - b. Missing glass
   - c. Inoperative
   - d. Corrosion
   - e. Illegible label

Carbon Dioxide (CO_2) Extinguisher

Items To Be Checked	Corrective Action

1. Mechanical damage to shell
   - a. Dents
   - b. Cracks
   - c. Paint condition
   - d. Threads
2. Name plate
   - a. Loose
   - b. Missing
   - c. Illegible wording
3. Horn and hose assembly
   - a. Damaged
   - b. Aged (brittle)
   - c. Cuts
   - d. Abrasions
   - e. Hand grip
4. Head assembly
   - a. Loose
   - b. Safety pin
   - c. Lead seal and wire
   - d. Safety disk
   - e. Red plastic cover

Items To Be Checked **Corrective Action**

5. Carriage and wheels
    - a. Lubrication
    - b. Broken
    - c. Corrosion
    - d. Warped wheels

Purple-K Dry Chemical Extinguisher, 10 and 30 Pounds

Items To Be Checked **Corrective Action**

1. Mechanical damage to shell
    - a. Dents
    - b. Punctures
    - c. Paint
2. Hose and nozzle assembly
    - a. Plugged
    - b. Cracks
    - c. Abrasions
    - d. Threads
    - e. Corrosion
    - f. Aged (brittle)
3. Pressure gauge
    - a. Inoperative
    - b. Dented
    - c. Illegible
4. Agent
    - a. Proper level
    - b. Agent condition
        - (1) Caking
        - (2) Contamination

Items To Be Checked **Corrective Actic**

5. Expelling agent
    a. Puncture mechanism
    b. CO_2 bottle
    c. Safety disk
    d. Weight check

Recharge portable fire extinguishers using the following checklist.

2 1/2 Gallon Foam Extinguisher

Step-by-step procedures for recharging:

1. Remove threaded cap.

2. Remove inner chamber.

3. Dump inner chamber and outer chamber.

4. Clean both chambers and parts thoroughly.

5. Mix package "A" (aluminum sulfate) in 2 1/2 pints of hot water (approximately 150°F). Make sure aluminum sulfate is completely dissolved. Pour into inner chamber.

6. Mix package "B" (sodium bicarbonate) in 1 3/4 gallons of warm water (approximately 110°F). Make sure solution is completely dissolved, then pour into outer chamber.

7. Place lead stopper in inner chamber.

8. Place inner chamber into outer chamber.

9. Replace threaded cap.

10. Seal extinguisher with lead seal and wire.

2 1/2 Gallon Pressurized Water Extinguisher

Step-by-step procedures for recharging:

1. Invert extinguisher.

2. Press lever to release pressure.

3. Remove head assembly.

4. Clean all parts thoroughly, wash valve and valve stem parts with water.

5. Lubricate stem "O" ring.

6. Fill with 2 1/2 gallons of water or appropriate solution (as directed on extinguisher name plate) to fill mark.

7. Replace head assembly.

8. Screw wing nut down hand tight.

9. Insert lever lock pin and seal wire (if required).

10. Press air chuck on air valve-pressurize to operating pressure with air or nitrogen.

11. Shake extinguisher, add pressure if necessary.

12. Gage must stay at operating pressure.

13. Hose and nozzle must be unobstructed.

Carbon Dioxide CO_2 Extinguishers Using a Transfer Pump and CO_2 Storage Cylinder

Step-by-step procedures for recharging:

1. Bleed off all pressure.

2. Remove hose assembly from head.

3. Attach adapter to head and connect filling hose to adapter.

4. Place extinguisher on scale and secure in position.

5. Adjust scale to give correct reading.

6. Open valve on extinguisher head and secure (use locking pin, wedge or clamp).

7. Open valve from supply tank to transfer pump.

8. Open bleed off valve from transfer pump, check flow of CO_2.

9. Close bleed off valve from transfer pump.

10. Open the supply valve from pump, start transfer pump.

11. Watch scale carefully to determine when full capacity of cylinder is reached.

12. When full capacity of cylinder is reached, stop pump, close valve on extinguisher head, close valve on supply line, and open bleed off valve from transfer pump.

13. Replace hose assembly and weigh extinguisher.

Purple-K Dry Chemical Fire Extinguisher, 10 lbs. and 30 lbs.

Step-by-step procedures for recharging:

1. To release pressure, invert extinguisher and squeeze hand grips (use outside area).

2. Remove valve.

3. Remove cap.

4. Fill shell with 10 lbs. or 27 lbs (manufacturer's purple "K" dry chemical only).

5. Clean valve, threads, plunger seal and collar "O" ring thoroughly.

6. Lubricate "O" ring.

7. Replace valve.

8. Replace cap.

9. Pull up puncture lever.

10. Remove empty pressure cartridge.

11. Weigh new pressure cartridge.

12. Check disk.

13. Replace pressure cartridge with new one.

14. Leave lever in up position.

15. Insert lock pin.

16. Install new lock seal.

17. Replace hose assembly.

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MODIFICATIONS

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Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-WB-112

PROTECTIVE CLOTHING

OBJECTIVE

After completing this workbook and classroom instruction, you will be able to inspect protective clothing.

EQUIPMENT

	Basis of Issue
Protective Clothing, Complete Set	1/10 students

PROCEDURE

Inspect protective clothing:

Item To Be Checked — Corrective Action

1. Hood
    a. Tears
    b. Burns
    c. Chemicals
    d. Rub places
    e. Tending to flake
    f. Peeling of aluminum coating
2. Hard hat assembly
    a. Snaps
    b. Straps
    c. Cracks
    d. Head band
    e. Chin strap
3. Face piece cover
4. Facepiece

Items To Be Checked	Corrective Action
5. Coat	
b. Cuts	
b. Peeling of aluminum coating	
c. Cleanliness	
d. Pockets	
e. Special snap fasteners	
6. Trousers	
a. Cuts	
b. Peeling of aluminum coating	
c. Cleanliness	
d. Knee pads	
e. snaps	
f. special snap fasteners	
7. Suspenders	
8. Boots	
a. Fit	
b. Cuts	
c. Clean	
9. Gloves	
a. Tears	
b. Tendency of aluminum coating to flake	
c. For structural gloves, insure that wool inserts are in proper placement	

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BLOCK II ORIENTATION

INTRODUCTION

TIME: 5 min

Attention: You are now entering block II which is a very important block. It not only concerns other peoples lives, but it can affect yours as well as members of your family.

Review: In block I we covered a number of subjects which were mission and organization, security, safety, principles and theory of combustion, extinguishing agents, extinguishers, NCP and missiles and weapons.

Overview: In this block we will cover breathing apparatus, rescue carries and first aid.

Motivation: You might think that some of the material we will be teaching in this block is dull, but have you ever had to save a life before? You may have to one day and if you can't, you may regret it for the rest of your life.

Transition: We will now start our orientation into block II.

BODY

TIME: 20 min

Presentation:

TIME: 15 min

1. Block content
   - a. Breathing apparatus
   - b. Rescue carries
   - c. Introduction to first aid
2. Safety
   - a. Precautions peculiar to the block
     - (1) Care and handling of equipment
     - (2) Horse play
     - (3) Leaning back on chairs
     - (4) Handling victims

3. Energy Conservation

    a. Electricity

    b. Cleaning materials

Application: TIME: N/A

Evaluation: TIME: 5 min

Intersperse throughout presentation.

CONCLUSION TIME: 5 min

Summary: We have discussed the block content, breathing apparatus, rescue carries and first aid; safety and energy conservation.

Remotivation: What you will be taught throughout this block is very important because many lives depend on your knowledge and skill in these areas.

Assignment: N/A. Continue into Breathing Apparatus.

Closure: That concludes our orientation of Block II.

BREATHING APPARATUS

INTRODUCTION

TIME: 5 min

Attention: You hear cries of help from inside a building that is heavily engulfed by smoke and gases. As a professional firefighter, you know that you will need a breathing apparatus to protect yourself and to help that person inside the building. Are you proficient in the use of the breathing apparatus? The victim is depending on your knowledge and skill.

Review: You have been briefed on what you will be taught during block II. The things you learned in block I go hand and hand.

Overview: During this class, we will be discussing the purpose of the breathing apparatus, listing its component parts, safety precautions to be observed, donning procedures, inspection, maintenance, and recharging.

Transition: We will begin our lesson by discussing the inspection and servicing of the self contained breathing apparatus.

BODY

TIME: 5 hrs 20 min

Presentation:

TIME: 1 hr 15 min

1. Given a self-contained breathing apparatus, don and operate apparatus in accordance with technical order data.

Energy and training material conservation. Conserve cleaning materials.

   a. Purpose: To provide complete respiratory protection in any concentration of noxious gases and/or areas of oxygen deficiency.

Show film TVL 57-26, "Scott Air Pack"

TO 14S5-7-1

   b. List component parts

Chart 67-203.1, Scott Air Pak

      (1) Air cylinder

         (a) Full cylinder provides air for thirty (30) minutes

         (b) Full cylinder should register 1980 PSI on air cylinder pressure gauge

         (c) Use of cylinder valve

        (d) Use of safety chain or pin locking device

        (e) Minimum operating pressure 1800 PSI, before recharging

    (2) Regulator and hose

        (a) Regulator pressure gauge

        (b) Regulator shut off valve (yellow) should be full open (counter clockwise)

        (c) Emergency by-pass valve (red) should be closed normally (clockwise); provides air in event of regulator malfunction

    (3) Mask assembly

        (a) Hose

        (b) Exhalation valve

        (c) Straps

        (d) Lens piece

    (4) Backplate and harness

c. List Safety Precautions

    (1) Cylinder air pressure must be known at the start of the operation to insure maximum duration

    (2) Regulator pressure gauge must be observed during use

    (3) Normal duration of air may be reduced by exertion or rapid breathing by user

    (4) Breathing apparatus does not protect wearer from flames, heat or skin irritation

    (5) Use only pure breathing air to recharge the cylinder

(6) When the air supply drops to 300 PSI, 4 minutes remain, and a warning bell will sound (if so equipped)

d. Donning Procedures

Use Breathing Apparatus

(1) Remove mask from case

(2) Remove apparatus from case

(3) Check air cylinder pressure gauge

(4) Check regulator shut off valve for full open position

(5) Check emergency by-pass valve for closed position

(6) Open cylinder valve three (3) full turns

(7) Connect safety chain or pin locking device

(8) Check regulator pressure gauge which should read same as the air cylinder pressure gauge. If not, use lowest PSI reading

(9) Open by-pass valve slightly to check air flow

(10) Put harness on as if it were a coat

(11) Fasten in order: Chest strap, side straps, and waist straps

(12) Put on face mask, placing chin in first and adjust head straps

(13) Check maskfor leaks by holding thumb over end of breathing tube and inhaling. The mask should collapse against face

(14) Check exhalation valve by again putting thumb over end of breathing tube, after taking a breath, and exhale. There should be no resistance if functioning properly

(15) Connect breathing tube to regulator assembly.

(16) Emergency Procedure - In the event of regulator malfunction during operation

(a) Open by-pass valve to provide sufficient air

(b) Close regulator shut off valve

INTERIM SUMMARY

2. Given a self contained breathing apparatus, inspect and service apparatus in accordance with technical order data.

a. Inspection periods

(1) Daily (visual)

(2) After each use (visual)

(3) Quarterly (operational)

b. Cleaning and Sanitizing

(1) Wash facepiece and breathing tube with mild soap and water (warm)

(2) Allow to air dry thoroughly

(3) Sanitize or disinfect with 70% ethyl alcohol

f. Recharging procedures

Use Chart # Scott Air Pack Recharging

Use air compressor

(1) Make sure air cylinder valve is closed

(2) Remove regulator hose from cylinder using wrench inside case

Stress safety

(3) Push release lever to remove cylinder from back plate and harness

(4) Check compressor oil level

(5) Connect cylinder to compressor

(6) Start compressor and equalize the pressure in compressor with air cylinder

(7) Open cylinder valve when pressure has equalized

(8) When air pressure reaches 1980 PSI, switch compressor off and close cylinder valve

(9) Bleed air pressure from compressor utilizing bleed off valve

(10) Disconnect cylinder from compressor

(11) Reconnect regulator hose to cylinder using wrench inside case

INTERIM SUMMARY

Application: Interspersed throughout the lesson TIME: 4 hrs

2 INSTRUCTORS ARE REQUIRED

Evaluation: Interspersed throughout the lesson TIME: 5 min

CONCLUSION TIME: 5 min

Summary: We have discussed the purpose of the breathing apparatus, its component parts and donning procedures. We mentioned certain safety precautions and what was required to inspect andmaintain the breathing apparatus.

Remotivation: The breathing apparatus can help you save lives, but more importantly, it can save yours.

Assignment: Read and study the following units and answer the questions at the end of each unit.

1. SG-203, Rescue Carries
2. SG-204, Introduction to First Aid
3. SG-205, Identification and Treatment of Shock

Closure: You must remain proficient in the operation of the breathing apparatus. You now have the knowledge to do so, but it is up to you to use it.

RESCUE CARRIES

INTRODUCTION

TIME: 5 min

Attention: The need to move a person is usually very urgent during a fire, and the process is often one of the most time consuming procedures. The primary concern is to carry the victim so as not to cause him further injury or to cause injury to the rescuer.

Review: We discussed the operation of the breathing apparatus, its purpose, safety, component parts and donning procedures.

Overview: During this lesson we will be discussing the principles of safety and removal of injured or unconscious personnel and rescue carries. We will be performing on the drag, back strap, fireman's and three man or stretcher carries, that may be used to remove victims from the fire area.

Motivation: It is your duty as a fire protection specialist to be proficient in rescue carries. You never know when you will have to use rescue procedures at the scene of the fire.

Transition: We will begin our lesson by discussing emergency rescue, transporting of victims utilizing rescue carries.

BODY

TIME: 3 hrs 50 min

Presentation:

TIME: 1 hr 45 min

1. Given a victim identified as requiring emergency rescue and/or short distance transfer, perform rescue carries. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and IFSTA 109 manual. All procedures must be strictly adhered to.

    a. Entry into building

        (1) The self-contained breathing apparatus allows the rescue personnel to enter dangerous smoke laden areas

        (2) Protection is offered from toxic fumes which may cause dizziness

    b. Types of forcible entry tools

Enery and materials conservation

Use: The American National Red Cross First Aid Manual

IFSTA #109

Transpariencies, Set #203

Stress Safety

(1) Door opener

(2) Pry bar

(3) Fire axe

(4) Any wedge shaped tool

c. Ways to gain entry

(1) Doors

(2) Windows

1. Wood frame

2. Metal frame

3. Factory type (similar to metal)

d. Before the rescueman enters a building, he should have a lifeline attached to him in case of any eventuality. The lifeline will lead to him and by the same token it will lead him back to his starting point.

e. Safety precautions

(1) Have charged hose line readily available

(2) Do not lift any person in excess of your own weight, use drag method

(3) Do not attempt to enter smoke or gas filled building without breathing apparatus or lifeline

(4) Use normal egress routes when possible

f. List procedures for locating personnel

(1) Use of pre-fire plans

(2) Use of information gained from personnel that have evacuated building

NOTE: Medical authorities are responsible for removing deceased personnel

g. Rescue carries for injured or unconscious personnel.

INTERIM SUMMARY

(1) Drag - victim is near an exit extremely heavy, or where lack of head room makes other carries impractical.

You must use proper handling of injured to prevent further injury

(2) Backstrap carry - victim's weight is equal to or less than that of the rescueman

(3) Fireman's carry - victim may be carried considerable distance. Rescueman will have his other hand free for protection and for moving obstructions. This carry can be used for descending stairs or ladders

Use 12' by 14' salvage cover as floor mat to perform rescue carries

(4) Arms Carry - recommended for carrying victim short distances

(5) Seat Carry - victim has minor injuries

(6) Chair - Litter Carry - Used for going up and down stairs or through narrow corridors, etc.

(7) Carry by Extremities - victim has no serious injuries to the body

(8) Three Man Carry - or Stretcher Carry - victim has severe injuries

h. Procedures for rescue carries

(1) Drag carry - place the victim on his back, grasp him beneath the arms

(2) Backstrap carry - victim is lying down and cannot help, the rescueman must also lie down with his back against victims chest. Reach over and bring his arm over your shoulder, grasp the clothing at the victims hip with the other hand and roll him over on top of you. From this position get on both knees, then to one knee, then stand up.

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(3) Firemans Carry - Place victim in the face down position, supporting his head on his arm. Straddle the victim, place your hands under his armpits and lift him to a standing position. Support the man with your arm around his waist and step in front of him. Grasp the victims wrist with your hand, bending your knees enough to locate your shoulder against his midsection, pull his arm around the back of your neck so that the victims body drapes across your shoulders. Slip your arm between his knees and bring his arm down to your hand and grasp it firmly by the wrist with your hand, then stand up.

(4) Arms Carry - The victim is grasped under the back with one arm and the knees with the other arm.

(5) Seat Carry - This is a two man carry which merely consists of carrying the victim on a "seat" provided by the rescueman's arms

(6) Chair - Lift Carry - Seat the victim on a strong chair, one rescueman at the back of the chair and the other at the front

Use straight back chair (industrial type)

(7) Carry by Extremities - One rescueman grasps the victim by the legs and the other grasps the victim under the arms and around the chest.

(8) Three man Lift - Three rescuemen line up on one side of victim and kneel on one knee, with one man at victims shoulder, and head one at hips and one between the knees/feet. Each man places hands and forearms under victims and at the command "lift" raises the victim placing him on a stretcher.

(9) Stretcher Carry - Three men are required to place victim on stretcher. The procedure for placing a victom on a stretcher is the same as preparing to lift on a three man carry.	Use stretcher, Pike Poles, and Bunker Coats (structural type)

Application: Interspersed throughout lesson TIME: 2 hrs

Evaluation: Interspersed throughout lesson TIME: 5 min

CONCLUSION

TIME: 5 min

Summary: During this class we have discussed structural rescue operations, its purpose, safety precautions, how to locate personnel, and what carries to use to rescue a victim.

Remotivation: Your job as rescueman cannot be over emphasized. Remember, your first duty as a firefighter is to save lives.

Assignment: N/A. Continue with Introduction to First Aid.

Closure: Remember well the idea that saving lives is the primary job of a firefighter. You should now be able to perform rescue to accomplish this.

INTRODUCTION TO FIRST AID

INTRODUCTION

TIME: 5 min

Attention: You have just seen your girlfriend fall down a flight of stairs. She may die unless someone can "properly" administer Emergency First Aid.

Review: Previously we have discussed the fireman's first responsibility. SAVE LIVES AND PROTECT PROPERTY.

Overview: During this lesson on emergency first aid, we will be discussing procedures for checking victims for injuries, prevention of contamination and the control of bleeding, preventing or reducing shock, procedures for applying a tourniquet, as well as inhalation, resuscitation, artificial respiration and aspiration procedures.

Motivation: Saving lives does not end with just rescue of victims. Ask yourself, what good am I if I can put all of my knowledge and machinery together to rescue someone, if I can only stand there and watch him die because I did not know the basic emergency first aid procedures to keep him alive?

Transition: Today's lesson begins with checking victims for injuries.

BODY

TIME: 50 min

Presentation:

1. Given a victim, identified as having been in an accident, demonstrate procedures for checking victims for injuries. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and IFSTA 109 Manual. All procedures must be accomplished with minimum instructor assistance.

    a. First Aid - immediate care given to those injured or suddenly taken ill.

    b. Reasons for first aid

        (1) Could mean difference between life and death

        (2) Accidents leading cause of injuries

        (3) Pattern of medical care changing

TIME: 15 min

Use: American National Red Cross First Aid Manual

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c. Value of first aid training - to give first aiders training to help others and selves during times of emergencies

d. General first aid

(1) Do not move victim unless necessary

(2) Protect victim from moving

(3) Maintain body temperature

(4) Determine injuries or cause of illness

(a) Obtain information from bystanders

(b) Look for medic alert ID

(c) Seek other identification or information

(d) Examine victim methodically.

e. Urgent Care

(1) Prompt rescue

(2) Open airway

(3) Severe bleeding

(4) Poisoning emergency

f. Examination procedures

(1) Expose body areas

(a) Use discretion

(b) Protect modesty

(2) Note victims general appearance

(a) Skin coloration

(b) Respiration

(3) Check pulse

(a) Average male 54-70 BPM

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(b) Average female 75-80 BPM

(c) Young child 82-180 BPM

(4) Note ability to answer questions

(a) Slurred speech

(b) Inability to remember

(5) If victim is unconscious, check for head injuries

(6) Check pupils for size and reaction

(7) Check trunk and limbs for wounds and fractures

(8) Check neck to see if victim is a possible laryngectomee

(9) Check for signs of poisoning

g. Carry out indicated first aid

(1) Apply emergency bandages and/or splints

(2) Immobilize victim

(3) Remain in charge of victim until qualified help relieves you

(4) Act within your capabilities of first aid

Use Casualty Kit
First Aid Equipment

Application: TIME: 30 min

Intersperse throughout lesson.

Evaluation: TIME: 5 min

Intersperse throughout lesson.

CONCLUSION TIME: 5 min

Summary: We have discussed checking victims for injuries, also the procedures have been demonstrated to you

Remotivation: It is very important to check victims for their injuries before trying to treat them, otherwise how would you go about the treatment.

Assignment: N/A. Continue with Identification and Treatment of Shock.

Closure: This ends our lesson on Introduction to First Aid.

IDENTIFICATION AND TREATMENT OF SHOCK

INTRODUCTION

TIME: 5 min

Attention: Have you ever seen a victim in shock? Would you be able to identify this from the signs and symptoms? How would you prevent or reduce shock?

Review: Earlier we discussed checking the victims for injuries.

Overview: This hour we will discuss identification and treatment of shock.

Motivation: Did you know that a victim could die from shock? There have been several cases where this has happened because no one knew the victim was in shock, and even if they did, they probably could not have treated the victim properly.

Transition: Let us now begin our lesson on identification and treatment of shock.

BODY

TIME: 50 min

Presentation:

TIME: 15 min

1. Given a victim identified as being in shock, demonstrate procedures to prevent or reduce shock. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and IFSTA 109 Manual. All procedures must be accomplished with minimum instructor assistance.

   a. The term "shock" may be used with many meanings. One of the most important to a first aider is a depressed condition of body functions, nerve disorder, and failure of blood circulation commonly known as injury shock decidedly different conditions are electric shock, insulin shock, fainting shock and phychiatric shock.

      (1) Causes and dangers of shock - Injury shock is directly associated with any injury to body tissue caused by burns, wounds, fractures of by loss of blood. The most common evidence of physical shock is

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- (a) Weakened condition
- (b) Dilation of eye pupils
- (c) Pale most skin that is cooler than it should be
- (d) Beads of perspiration may be noted above the lips, forehead, also palms and armpits.
- (e) Victim may vomit or complain of nausea
- (f) Mental reaction of the victim may appear normal at first, but he may become restless, lose alertness, and interest
- (g) Thirst is usually present
- (h) Pulse may be weak
- (i) Victim may breath rapidly with occassional deep breaths

(2) First aid for shock (position)

- (a) Position
  - 1. Keep victim lying down
  - 2. Blood loss is severe, elevate lower part of the body 8 to 12 inches
  - 3. Do not elevate the lower extremities if:
    - a. There is a head injury
    - b. Breathing is difficult
    - c. Victim complains of pain

d. If any of these conditions are present, the head and shoulders should be elevated by placing an object under them

(b) Heat

1. Place a blanket beneath the victim and cover him according to the temperature of the environment

2. Victim should not sweat

3. Do not add heat, simply prevent a loss of body heat

(c) Fluids

1. Fluids should not be administered except to satisfy thirst

2. Plain water, at normal temperature, is the only fluid a first aider should administer

Casualty Kit

First Aid Equipment

3. Give only a few sips at first; increase to as much as a half a glass

4. If victim vomits or becomes nauseated, do not give fluids

Application: TIME: 30 min

Interspersed throughout lesson.

Evaluation: TIME: 5 min

Interspersed throughout lesson.

CONCLUSION TIME: 5 min

Summary: Today we have discussed identification and treatment of shock.

Remotivation: Now it is up to you to apply what you have learned here today toward helping your fellow man or woman as you would want them to help if you needed it.

Assignment: Read and study the following SG units and answer the questions at the end of each unit.

1. SG-206, Swallowed Objects and Choking
2. SG-207, Poisoning and Drugs
3. SG-208, Identification and Treatment of Wounds
4. SG-209, Identification and Treatment of Specific Injuries

Closure: That concludes our lesson for today.

SWALLOWED OBJECTS AND CHOKING

INTRODUCTION

TIME: 5 min

Attention: What would you do if you came upon a victim that had swallowed some object and was choking to death? Would you give the victim a glass of water?

Review: Yesterday we discussed checking victims for injuries and the identification and treatment of shock.

Overview: The first hour we will discuss treatment for victims from swallowed objects and choking

Motivation: Have you ever swallowed a large piece of meat not fully chewed and it hung in your throat?; then you started coughing and choking. After it was coughed up you sure were relieved, but what if you could not have coughed it up and did not know what else to do.

Transition: Now we will discuss the things to do for swallowed objects and choking.

BODY

TIME: 50 min

Presentation:

TIME: 45 min

1. Without reference, identify procedures for administering emergency first aid treatment for swallowed objects and choking. Eighty percent of the procedures must be identified correctly.

   a. Causes for choking

      (1) Eating without dentures

      (2) Large piece of meat not fully chewed

      (3) Inedible object becomes lodged in throat

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   b. Signs and symptoms

      (1) Violent choking

      (2) Alarming attempts at inhalation

      (3) Discoloration of face, neck and hands (blue)

- (4) Stoppage of breathing
- (5) Unconsciousness

c. First Aid

- (1) Swallowed objects in food passage
  - (a) Nothing by the mouth
  - (b) Remove with fingers if possible
  - (c) Sharp blow to mid-back with victim inverted
- (2) Objects in larynx or lower air passages
  - (a) Seek medical help
  - (b) Allow victim to assume most comfortable position
  - (c) Do not attempt to remove object with fingers
  - (d) Encourage coughing
  - (e) Remain calm and reassure victim
  - (f) Do not give anything by mouth
- (3) Foreign body prohibiting ventilation
  - (a) Artificial respiration only if victim stops breathing
  - (b) Sharp blow to mid-back to attempt to dislodge object
  - (c) Get medical attention as soon as possible

Application: TIME: N/A

Evaluation: TIME: 5 min

Intersperse throughout lesson.

CONCLUSION

TIME: 5 min

Summary: Now that we know how to identify a victim suffering from some swallowed object and choking, we can administer the correct first aid treatment.

Remotivation: A person can die from swallowed objects and choking, so you must remember how to administer the correct first aid treatment so that life is saved.

Assignment: N/A. Continue into Poisoning and Drugs

Closure: This ends our discussion on swallowed objects and choking.

POISONING AND DRUGS

INTRODUCTION TIME: 5 min

Attention: Have you ever seen a person in the movies that had been poisoned or had an overdose of drugs with five or six other people standing around watching that person die needlessly?

Review: We have learned the treatment for shock and choking, and how to identify the victims needing this treatment.

Overview: This next hour we will be discussing how to identify and treat victims that have been poisoned or have taken an overdose of drugs.

Motivation: We never know when we will encounter a victim with one of these symptoms and if we are able to save that person's life by the knowledge we have acquired, it should be very gratifying.

Transition: So let's start our lesson on poisoning and drugs.

BODY TIME: 50 min

Presentation: TIME: 45 min

1. Without reference, identify procedures for administering emergency first aid for poisoning. Eighty percent of the procedures must be identified correctly.

- a. Poisoning substances
  - (1) Solid, liquid or gas that tends to impair health or cause death when introduced into body or onto skin surface
- b. Causes of Poisoning
  - (1) Frequent causes
    - (a) Careless storage
    - (b) Overdose
  - (2) Examples of poisoning around the house
    - (a) Gasoline
    - (b) Bleach

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(3) Ways of poisoning

   (a) By mouth

   (b) Absorbtion

   (c) Inhalation

   (d) Ingestion

(4) Signs and symptoms

   (a) Symptoms vary

   (b) Aid in determining poisoning

      1. Information from victim or observer

      2. Container

      3. Victim's condition

      4. Burns about lips or mouth

      5. Breath odor

      6. Pinpoint size of eyes

(5) Objectives in treatment - poisoning by mouth

   (a) Dilute or neutralize

   (b) Induce vomiting (except as advised

   (c) Maintain respiration

   (d) Seek immediate medical assistance

(6) First Aid

   (a) Begin to carry out objectives

   (b) If not strong acid, alkali or petroleum

      1. Dilute

      2. Induce vomiting

      3. Get medical help

(c) If you don't know what poison was

1. Dilute

2. Find out what poison (look for container)

3. Get medical help

(d) Additional Information

1. Maintain open airway

2. Do not give fluids if unconscious

3. Use phone to gain advice

    a. Doctor

    b. Hospital

    c. Poison Control Center

    d. If available, use commercial antidote

    e. Save label and vomitus for physician

    f. Estimate amount taken

    g. If victim is convulsing do not give medication or induce vomiting

    h. After convulsion, turn victim on side or face down with head to the side

4. Give demulient to coat insides

    a. Milk

    b. Olive Oil

    c. Egg white

(7) Contact Poisons

  (a) Chemical burns

  (b) Contact with poisonous plants

  (c) First Aid for contact poisons

    1. Remove contaminated clothing

    2. Thoroughly clean with soap and water

    3. Follow by rubbing alcohol

    4. Apply calamine or other soothing lotion

    5. Seek medical help

INTERIM SUMMARY

2. Without reference, identify procedures for emergency first aid treatment for drugs. Eighty percent of the procedures must be identified correctly.

a. Signs and Symptoms

American National Red Cross First Aid Manual

  (1) Vary depending on substance involved

  (2) Apparatus

  (3) Needle Marks

  (4) Bottles

  (5) Pupils of Eyes

    (a) Constricted

      1. Barbiturates

      2. Narcotics - etc.

    (b) Dilated

      1. Hallucinogens

      2. Cannabis

  (6) Respiration - usually slow

  (7) Pulse - varies depending upon substance used

b. First Aid

  (1) Maintain respiration

  (2) Maintain circulation

  (3) Maintain body heat

  (4) Transport to medical facility immediately

Application: TIME: N/A

Evaluation: TIME: 5 min

Interspersed throughout lesson.

CONCLUSION

TIME: 5 min

Summary: Now you know how to recognize a victim and treat him or her for poisoning and drugs.

Remotivation: I'm sure you have seen people that were poisoned or had overdosed, these people do not have to die if the proper treatment is administered to them at the proper time.

Assignment: N/A. Continue into Identification and Treatment of Wounds

Closure: That ends our lesson on poisoning and drugs.

IDENTIFICATION AND TREATMENT OF WOUNDS

INTRODUCTION

TIME: 5 min

Attention: Did you know that a wound has a classification and that there are different types of wounds? So, you can see that it is more to it than just having a cut.

Review: The last hour we discussed poisoning and drugs, their signs and symptoms.

Overview: For the next hour we will talk about identification and treatment of wounds. You will then be required to treat these different wounds.

Motivation: You can cause a person to have more problems with a wound by incorrect treatment, than if you had never treated him. So, you can see that you must give the proper treatment for the type of wound that person has.

Transition: Let us now start our lesson and identify wounds.

BODY

TIME: 1 hr, 50 min

Presentation:

TIME: 45 min

1. Given a victim, identified as having a wound, demonstrate procedures for the prevention of contamination and the control of bleeding. Procedures utilized must be in accordance with the American National Red Cross First Aid manual and the IFSTA 109 manual. All procedures must be accomplished with minimum instructor assistance.

   a. Wound is a break in continuity of tissue

      (1) Classification of Wounds

         (a) Open

         (b) Closed

      (2) Types of Wounds

         (a) Abrasions

         (b) Incisions

         (c) Lacerations

         (d) Punctures

         (e) Avulsions

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(3) Common causes

(4) Sumptoms

(5) First Aid for open wounds

  (a) Stop bleeding

  (b) Protect wound from contamination

  (c) Treat for shock

  (d) Obtain medical aid

(6) First aid for severe bleeding

  (a) Direct pressure

  (b) Hand or cloth directly on wound

  (c) Do not uncover, if blood soaked, add more layers

  (d) Pressure bandage may be applied

  (e) Elevation raise wound above heart

(7) Pressure Points

  (a) Direct pressure, elevation and pressure points should be used together

  (b) Brachial artery - upper extremeties

  (c) Femoral artery - lower extremeties

(8) Tourniquet

  (a) Utmost last resort

    (1) Loss of life possible

    (2) Loss of limb

  (b) Strong 2" wide materials

  (c) Place between wound and heart immediately following wound

- (d) Use strong stick to twist tight
- (e) Tighten til bleeding stops
- (f) Mark time applied
- (g) Never loosen
- (h) Treat for shock
- (i) Transport to medical facility immediately

(9) Prevention for contamination and infection measures to take with wounds

- (a) First Aider should wash hands
- (b) Clean wound
- (c) Dress and bandage wound
- (d) Seek medical aid if infection develops

(10) Removal of foreign objects

- (a) Just beneath skin sterile needle
- (b) Deep objects - leave for doctor

(11) Infection symptoms

- (a) Swelling
- (b) Redness
- (c) Heat
- (d) Throbbing
- (e) Tenderness
- (f) Fever
- (g) Pus
- (h) Swollen Lymph Glands
- (i) Red streaks

Casualty Kit

First Aid Equipment

Application: TIME: 1 hr

Intersperse throughout lesson.

Evaluation: TIME: 5 min

Intersperse throughout lesson.

CONCLUSION TIME: 5 min

Summary: We have discussed the two classifications of wounds, and the different types of wounds and the treatment for the different types.

Remotivation: You should now be able to identify wounds and administer proper treatment for all types of wounds. You would not want an inexperienced person treating your wounds so don't be inexperienced when you have to treat someone elses.

Assignment: N/A. Continue into Identification and Treatment of Specific Injuries.

Closure: That ends our lesson on treatment of wounds.

IDENTIFICATION AND TREATMENT OF SPECIFIC INJURIES

INTRODUCTION

TIME: 5 min

Attention: Do you know what specific injuries are? How to recognize them and treat this type of injury?

Review: We have learned how to treat wounds, and the classification and types of wounds?

Overview: Now we will learn what specific injuries are and the treatment we should use for them.

Motivation: If you ever encounter specific injuries you will never forget it. They are very serious and the proper treatment must be administered.

Transition: Now let us begin our discussion on specific injuries.

BODY

TIME: 1 hr 50 min

Presentation:

TIME: 45 min

1. Without reference identify procedures for administering emergency first aid for burns. Eighty percent of the procedures must be identified correctly.

   a. Three general kinds of burns

      (1) Thermal burns

      (2) Sunburn

      (3) Chemical burns

   b. Classification of burns

      (1) First degree - skin is reddened

      (2) Second degree - blisters develop

      (3) Third degree - deep destruction

   c. Thermal burns are caused by direct flame or radiated heat

      (1) Treat for shock

      (2) Relieve pain

      (3) Prevent infection

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d. First aid for burns may be regarded as

   (1) Partial thickness injury

   (2) Full thickness injury

e. Partial thickness burns

   (1) Always very tender

   (2) Benefit from immediate application of cold water

   (3) Loosened superficial skin may be removed only if it is bunched of folded

f. Full thickness injuries (depth)

   (1) More serious and complicated

   (2) Involves the entire thickness of the skin

   (3) Produces the unmistakable dark, dry eschar

   (4) Apply cold water and cold water compresses

   (5) Wrap the victim in a clean sheet prior to transportation to the hospital

   (6) Cover the burned area with clean sterile dressing

   (7) Cut clothing from around burn area - do not disturb burn area(s)

   (8) If eyes are burned, flush them with water if victim can stand the pain

   (9) DO NOT apply oil or ointments in the eyes

   (10) Use judgement when giving fluids to a victim as this usually causes nausea

   (11) Give half-glass doses of a solution made by dissolving one-half teaspoon of table salt or one-half teaspoon of baking soda in a quart of water if medical assistance is delayed for one

(12) Keep victim covered to retain body heat

g. Sunburns

(1) Caused by ultraviolet rays of the sun

(2) Over exposure to the sun's rays rays cause tiny blood vessels in the skin to dilate and the skin becomes red.

(3) As overexposure increases tissue injury starts

(4) Swelling of the skin occurs

(5) Blisters appear

(6) Fever develops

(7) Discomfort

(8) Sunburn becomes serious, should the injured tissue become infected. (First and second degree burns)

(9) Treat mild sunburns with any good ointments, cold cream, body lotion or salad oil to relieve pain

(10) DO NOT use oil or margarine or butter

Use Casualty Kit

Use First Aid Equipment

(11) Apply sterile dressing if skin is blistered

(12) Do not expose burned area to sun until it is completely healed

(13) Do not apply oil or ointments to severe sunburn cases

(14) Seek medical help for severe cases of sunburn

h. Chemical Burns to the Skin

(1) Acid burns are non-progressive injuries. Damage to tissue ceases when acid is removed

(2) Alkali burns - progress with time

(3) Alakli burns may first appear to be slight, but may later develop deep inflamation and tissue destruction unless you seek medical help by a physician

(4) Wash away chemicals with large quantities of water

(5) Read labels for first aid measures

(6) Apply additional first aid as described for any other similar heat burns

i. Chemical burns of the eye

(1) Type of chemical will determine the degree of injury

(2) Do not waste time trying to find out what chemical is in the eye

(3) Flush the eyes immediately with large amount of cool water

(4) You cannot use too much water

(5) The first few seconds and the next few minutes are the most important

(6) After thorough irrigation, a few drops of clean mineral, castor, or vegetable oil can be placed in the eye

(7) The oil helps prevent the eyelid from sticking to the eyeball

(8) Cover the damaged eyes with a sterile compress and seek immediate medical help

INTERIM SUMMARY

2. Without reference, identify procedures for administering emergency first aid for frost bite and cold exposure. Eighty percent of the procedures must be identified correctly.

a. Frost bite

(1) Characteristics

(a) Common injury due to cold

        (b) Usually small area affected

b. Signs and symptoms

    (1) At first

        (a) Skin changes to white or grayish yellow

        (b) Possible pain

        (c) Blisters

        (d) Intense cold and numbness

        (e) Victim may be unaware of frost bite

    (2) As time passes

        (a) Mental confusion

        (b) Impairment of judgement

        (c) Victim staggers

        (d) Eyesight fails

        (e) Possible unconsciousness

        (f) Shock

        (g) Breathing may cease

        (h) Death, if occurs, may be due to heart failure

c. First Aid

    (1) Objectives

        (a) Protect area from further injury

        (b) Warm area rapidly

        (c) Maintain respiration

    (2) Procedures

        (a) Cover frozen part

        (b) Provide extra clothing and blankets

        (c) Bring victim indoors as soon as possible

(d) Give victim warm drink

(e) Rewarm part quickly

(f) Immerse in warm water

(g) Warm at room temperature if part has been frozen-thawed and refrozen

(3) Do not apply hot water bottle or heating lamp

(4) Do not heat at hot stove

(5) Do not break blisters

(6) Do not allow victim to walk if feet area affected

(7) Discontinue warming as soon as part becomes flushed

(8) After part is warmed, exercise if toes or fingers are involved. Place cover between them to keep them separated

(9) Do not apply other dressings unless transporting for medical aid

(10) Elevate frostbitten parts and protected area contact with bed clothes

(11) Seek medical aid ASAP

d. Cold Exposure

(1) Manifestations

(a) Shivering

(b) Numbness

(c) Low body temperature

(d) Drowsiness

(e) Muscular weakness

(2) First Aid — Casualty Kit

(a) Give artificial respiration if necessary — First Aid Equipment

(b) Bring victim into warm room ASAP

(c) Prevention of injuries of cold

INTERIM SUMMARY

3. Without reference, identify procedures for administering emergency first aid treatment for heat stroke, heat cramps and heat exhaustion. Eighty percent of the procedures must be identified correctly.

a. Heat stroke

(1) Response of the body to heat characterized by extremely high body temperatures

(a) Signs and symptoms

1. High body temperature

2. Skin may be red, hot and dry

3. Pulse rapid and strong

4. Victim may be unconscious

(b) First aid

1. Undress, but maintain modesty

2. Apply cold sponge and water or alcohol

3. Use fans or air conditioners to promote cooling

4. Start above if body begins to heat up again

5. Do not give stimulants

b. Heat cramps - muscular pain and spasms due to loss of salt

(1) Leg muscles and abdomin likely to be affected first

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(2) First Aid

(a) Gently massage muscles; give sips of salt water

(b) ½ glass every 15 minutes over period of 1 hour

c. Heat exhaustion

(1) Response of body characterized by fatigue, weakness and collapse due to inadequate water intake and rapid fluid loss

(2) Symptoms

(a) Approximately "normal" body temperature

(b) Pale and clammy skin

(c) Profuse sweating

(d) Tiredness, weakness

(e) Headache, perhaps cramps

(f) Nausea - dizziness

(g) Possible fainting

(3) First Aid

(a) Give sips of walt water — Casualty Kit

(b) Lay victim down — First Aid Equipment

(c) Loosen clothing

(d) Apply cool, wet cloths

(e) Stop fluids if victim vomits

(f) Advise against further sunlight

Application: TIME: 1 hr

Intersperse throughout lesson.

Evaluation: TIME: 5 min

Intersperse throughout lesson.

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CONCLUSION

TIME: 5 min

Summary: We have discussed specific injuries, how to identify these injuries and the treatment of specific injuries.

Remotivation: I am sure now that you see the importance of being able to identify specific injuries and the damage they can cause without proper treatment. You should be able to apply that proper treatment.

Assignment: Read and study SG unit 210, Dressing, Bandaging and Splinting, and answer the questions at the end of the unit.

Closure: This ends our instruction for today.

DRESSING, BANDAGING AND SPLINTING

INTRODUCTION

TIME: 5 min

Attention: Have you ever applied a dressing or bandage, or splinted a broken arm or leg? Did you do it correctly?

Review: Yesterday we discussed specific injuries, treatment of wounds, poisoning and drugs, and also swallowed objects and choking.

Overview: Today we will cover dressing, bandaging and splinting and you will be required to perform these on your fellow students.

Motivation: You must use the correct methods in dressing or bandaging a wound, also in sprinting a fracture because you can cause the victim to be cripple or maimed for the rest of his or her life. It could be a member of your own family.

Transition: So, let's begin our lesson for today.

BODY

TIME: 5 hrs 50 min

Presentation:

TIME: 2 hrs 45 min

1. Given a victim identified as needing a dressing or bandage, demonstrate procedures for applying a dressing or bandage. Procedures utilized must be in accordance with American National Red Cross First Aid Manual. All procedures must be accomplished with minimum instructor assistance.

   a. Dressing and bandages

1 (1) Dressings - immediate protective cover placed over wound

   (2) Function - Prevent contamination

   (3) Sterilization procedures

   (4) Bandages - material to hold dressing to wound or splint in place

   b. Applying bandages

   (1) General principles

   (2) Elastic bandage

Energy and Training Materials conservation

Conservation of Cleaning Materials

American National Red Corss First Aid Manual

IFSTA #109

Transparencies Set #210

Casualty Kit

First Aid Equipment

(3) Gauze bandages

(4) Triangular bandages

(5) Adhesive strip dressings

c. Methods of applying bandages

(1) Arm sling

(2) Triangular bandage for folded cravat

(3) Triangular for scalp and forehead

(4) Cravat for forehead, ears or eyes

(5) Cravat for cheek and/or ear

(6) Cravat for elbow and/or knee

d. Anchoring bandages

(1) Tying off bandages

(2) The circular turn

(3) Open and closed spiral bandage

(4) Figure eight bandages

(5) Finger tip bandages

INTERIM SUMMARY

2. Given a victim identified as needing a tourniquet, demonstrate procedures for applying a tourniquet. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and IFSTA 109 Manual. All procedures must be accomplished with minimum instructor assistance.

a. The tourniquet should be used only as a last resort for severe, life threatening hemorrage that cannot be controlled by other means

b. The use of the tourniquet method of controlling bleeding, is mentioned principally to discourage its indiscriminate use

(1) Tourniquets may cause tissue injuries

(2) Shuts off the entire blood supply to that part of the body to which it is applied

(3) The device itself ofter cuts into or injures the skin

(4) Tourniquets may be necessary in cases of partial or complete severance of a body part

(5) These are the only instances where its application may be justified

(6) Victim must be taken to a physician as soon as possible after a tourniquet has been applied

(7) Physicians or medical personnel should be the only ones permitted to release a tourniquet

Casualty Kit

First Aid Equipment

(8) Constriction band should be made from some flat material about two inches wide

(9) Avoid the use of rope, cords, wire, string or other materials of small circumference

(10) These materials will only cut the skin and possibly damage good muscle and cause more blood loss

c. Procedures for applying a constriction band

(1) Select a soft, sturdy, and wide material for the band

(2) Pass the band material around the limb or body member between the wound and the heart

(3) Wrap the band tightly around the limb to stop or slow down the bleeding

(4) Use a stick or other strong material to apply pressure on the constriction band, when the constriction band is snug, secure object with piece of cloth or other material.

(5) Cover the wound with a sterile compress

INTERIM SUMMARY

3. Given first aid and equipment, and a victim identified as having a fracture, demonstrate procedures for administering first aid for fractures. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and IFSTA Manual 109 with minimum instructor assistance.

American National Red Cross First Aid Manual

IFSTA #109

a. Types

(1) Closed fracture - simple

(2) Open fracture - compound

b. Signs and symptoms

(1) Pain - point tenderness

(2) Deformity

(3) Loss of function

(4) Swelling

(5) Discoloration

c. Dangers

(1) Improper handling may cause fracture to become open

(2) Damage nerves and blood vessels

d. First Aid Procedures

Casualty Kit

First Aid Equipment

(1) Immobilize bone ends

(2) Immobilize joint above and joint below fracture

(3) Leave joint injuries in position found

(4) Slight traction on straight bone injuries

Application: TIME: 3 hrs

Intersperse throughout lesson. **2 INSTRUCTORS ARE REQUIRED**

Evaluation: TIME: 5 min

Intersperse throughout lesson.

CONCLUSION

TIME: 5 min

Summary: Today we have covered dressings, bandaging and splinting. You have performed these so you should have a better understanding of this now.

Remotivation: As you have seen, if these procedures are not performed correctly, you will be doing more damage than good, so you must remember the correct procedures in administering first aid treatment to a victim.

Assignment: Read and study the following SG units and answer the questions at the end of each unit.

1. SG-211, Sudden Illness
2. SG-212, Respiratory Emergencies and Artificial Respiration

Closure: Remember what you learned today can save a life.

SUDDEN ILLNESS

INTRODUCTION

TIME: 5 min

Attention: How many of you know what sudden illnesses are?

Review: Yesterday we learned how to apply dressings, bandaging, and splints, the different types and their specific use.

Overview: Today's lesson will cover sudden illnesses and respiratory emergencies and artificial respiration.

Motivation: Sudden illnesses are not uncommon and they can happen to anyone. Some members of your family probably already have some of these illnesses, so by you knowing how to treat them, you will be able to save their lives.

Transition: So, let us begin our lesson for today.

BODY

TIME: 50 min

Presentation:

TIME: 45 min

1. Without reference, identify procedures for administering emergency first aid for sudden illnesses. Eighty percent of the procedures must be identified correctly.

    a. Heart Attack

        (1) Signs and symptoms

            (a) Persistent chest pains

            (b) Chest and sternum area

            (c) Left shoulder and arm

            (d) Gasping and shortness of breath, bluish color lips, skin, fingernail beds

            (e) Extreme prostration

            (f) Shock

            (g) Swelling of ankles

American National Red Cross First Aid Manual

Energy and Training Material Conservation

Conservation of cleaning materials

Transparencies Set #211

(2) **First Aid**

  (a) Allow victim to be comfortable

  (b) Provide ventilation

  (c) Protect against drafts

  (d) Use artificial respiration if necessary

  (e) Help with prescribed medicine if victim has any difficulty

  (f) Do not give liquids if victim is unconscious

b. Stroke - apoplexy

(1) Spontaneous rupture of a blood vessel in the brain or formation of a clot that interferes with circulation

(2) Major stroke

  (a) Signs and symptoms

    1. Unconsciousness

    2. Paralysis or weakness one side of the body

  (b) Main symptoms

    1. Difficulty in breathing and swallowing

    2. Loss of bladder or bowel control

    3. Pupils unequal

    4. Lack of ability to talk or slurred speech

  (c) First Aid

    1. Provide moderate covering

    2. Maintain airway

3. Give artificial respiration if necessary

4. Position victim so that secretions will drain from mouth

5. Obtain medical aid

6. Do not give liquids unless victim is able to swallow

(d) Minor stroke

1. May happen in sleep and be accompanied by

a. Headache

b. Confusion

c. Slight dizziness

d. Ringing in ears

e. Other mild complaints

2. Later

a. Minor difficulties in speech

b. Memory changes

c. Weakness in an arm or leg

d. Disturbance in normal personality

(e) First Aid

1. Protect victim against accident or physical exertion

2. Suggest medical attention

c. Fainting due to loss of blood in brain

(1) Signs

(a) Extreme paleness

(b) Sweating

- (c) Coldness of the skin
- (d) Dizziness
- (e) Numbness and tingliness of hands and feet
- (f) Nausea
- (g) Possible disturbed vision

(2) First Aid

- (a) Leave victim lying down
- (b) Loosen clothing
- (c) If victim vomits, roll head to drain fluids
- (d) Maintain airway
- (e) Do not pour water on face
- (f) Give no liquids
- (g) Examine victim
- (h) Seek medical aid if recovery is slow

(3) Convulsion

- (a) Rigid body muscles lasting a few seconds to half minute
- (b) Bluish discoloration of face lips, foaming at the mouth or drooling
- (c) Gradually subsides

(4) First Aid

- (a) Prevent victim from hurting himself
- (b) Give artificial respiration if needed
- (c) Do not place object between teeth
- (d) Do not pour liquids in mouth

(e) Do not restrain victim

(f) Do not place child in tub of water

d. Epilepsy

(1) First Aid

(a) Push away near objects

(b) Do not force object between teeth when jerking is over, loosen clothing.

(c) Keep victim lying down

(d) Maintain airway

(e) Prevent drowning in vomit

1. Turn head to side or place on stomach

(f) Give artificial respiration if necessary

(g) After seizure allow victim to rest or sleep

(h) Seek medical attention

Application: TIME: N/A

Evaluation: TIME: 5 min

Intersperse throughout lesson

CONCLUSION

TIME: 5 min

Summary: The last hour we have covered sudden illnesses, heart attacks, strokes, convulsions and epilepsy.

Remotivation: You can see how serious these illnesses can be, so it is up to you to administer the proper care during an emergency of this type.

Assignment: N/A. Continue into Respiratory Emergencies and Artificial Respiration.

Closure: That ends our lesson on sudden illness for today.

RESPIRATORY EMERGENCIES AND ARTIFICIAL RESPIRATION

INTRODUCTION

TIME: 5 min

Attention: Can you perform artificial respiration? Everyone should know how to do this.

Review: We covered sudden illnesses the last hour, which consisted of heart attacks, strokes, convulsions and epilepsy.

Overview: The next five hours we will learn artificial respiration and we will also be performing this.

Motivation: There are all types of emergency situations where artificial respiration can save someone's life, if done in the proper manner. We will teach you this, but it is up to you to apply it correctly.

Transition: Now we will start our lesson for today.

BODY

TIME: 4 hrs 50 min

Presentation:

TIME: 1 hr 15 min

1. Given a resuscitation manikin, demonstrate procedures for administering artificial respiration. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and IFSTA 109 Manual. All procedures must be accomplished with minimum instructor assistance.

   a. Before giving mouth to mouth resuscitation, diagnois signs for the following

      (1) Respiration'

      (2) Pulse

      (3) Pupils of eyes

      (4) Skin color

      (5) Skin temperature

      (6) State of consciousness

      (7) Paralysis/loss of sensation

Energy and Training Material Conservation

Conservation of Cleaning Materials

American National Red Cross First Aid Manual

IFSTA #109

Transparencies Set #212

Film: TF 6296, "Mouth to Mouth Resuscitation"

    (8) Reaction to pain

b. Respiratory System

    (1) Air moves through many structures on its way to the lungs, where oxygen is exchanged for waste products

    (2) Air moves first through the mouth and nose to the throat

        (a) Contains 20 to 21% oxygen, and 78 to 79% nitrogen

    (3) Breathing Process

        (a) Inspiration

            1. Muscles move ribs outward

            2. Diaphragm moves downward

        (b) Expiration

            1. Muscles relax, ribs move inward

            2. Diaphragm relax, moves upward

    (4) Inspiration/Expiration phase moves about 500cc one (1) pint of air, lungs extract 5% of the oxygen

c. Determine need for mouth to mouth or mouth to nose resuscitation

    (1) Breathing impaired/stopped completely

        (a) Electrical shock

        (b) Barbiturates/drugs

        (c) Toxic gases

        (d) Heart disease/asthma

Film: TF 6555, "Save That Life"

Resuscitation Manikins

Resuscitation Devices

Aspirators

Airways

(2) Foreign matter in mouth

(a) Food, vomit, phlegm mucus

(b) Food, foreign objects

(3) Recocognition of airway obstructions

(a) Look

(b) Listen

(c) Feel

(4) Treatment of airway obstruction

(a) Clean patients mouth

(b) Tilt patients head back

(c) Force air into patients mouth

(d) Chin lift method

(e) Jaw lift method

d. Identify mouth to mouth resuscitation procedures

(1) Pulmonary resuscitation

(a) Establish airway

(b) Seat patients nose (hand or your cheek)

(c) Inhale deeply (1000cc) place mouth upon patients mouth

(d) Exhale into patients mouth

(e) Remove mouth, patient will exhale

(f) Repeat every

1. 0-6 years - 20 times per minute (small puffs of air)

2. 6-13 yrs - 20 times per minute (light pressure)

3. 13 and up - 12-15 times per minute (1000cc) of air

(2) Mouth to nose

(a) Used if patient has lower jaw injuries

1. Clamp patients jaw shut with your fingers

2. Cover his nose with your mouth

3. Blow into nose and watch for chest rise

4. Open mouth to allow patient to exhale through mouth

(3) Mouth to Stoma

(a) Use same basic techniques as mouth to mouth except mouth placement

(b) Use twice normal breath at one every five seconds

(c) If air escapes through mouth or nose - partial laryngectomy, seal mouth and nose and proceed as above

INTERIM SUMMARY

2. Given a resuscitation manikin, WB and resuscitation device, demonstrate inhalation procedures. Procedures utilized must be in accordance with the WB checklist. All procedures must be strictly adhered to, with help from the instructor on difficult areas.

Use WB-212

a. Clear mouth and throat of foreign materials if necessary, preferably with a clean cloth around fingers

b. Place manikin on its back with a folded blanket, coat or similar object under the shoulders

c. Extend head back, pull chin up, apply bag mask

(1) Hold mask firmly on face with thumb and index finger, other fingers gripping the chin

(2) Inflate lungs by squeezing bag with other hand (or use oxygen bottle for air supply)

(3) Observe rise and fall of chest for proper ventilation

0-6 yrs - 20 times per minute
6-13 yrs - 20 times per minute
14 and up - 12-15 times per minute

(4) Assist manual resuscitation with automatic resuscitator and voluntary effort

INTERIM SUMMARY

3. Given a resuscitation manikin, WB and resuscitation device, demonstrate aspiration procedures. Procedures utilized must be in accordance with the WB checklist. All procedures must be accomplished with minimum instructor assistance.

a. Aspiration techniques with mechanical aspirator

(1) Check victim for airway obstruction by:

(a) Looking

(b) Listening

(c) Feeling

(2) If aspiration is necessary

(a) Position victim on his back

(b) Turn head to one side

(c) Remove the air shield footsuction pump from the case

(d) Position foot suction pump near victims head

Resci-Anne/Resci-Andy Manikins

Bag Masks

(e) Hold metal tip in mouth of victim and pump the bellows with your foot. Continue as long as suction is needed

(f) Pumping the bellows creates sufficient suction to remove obstructing fluids

(g) Even if the trap jar should overflow, it is not necessary to discontinue operation since the aspirated liquid will enter the bellows and will automatically be emptied from the bellows with the next compression

(h) The extra ball valve on the rubber trap jar cover simply serves as a spare in case the other becomes clogged.

(3) Cleaning the foot pump

(a) Wash the metal tip in soap and water or a disinfecting solution

(b) Since all flow is away from the fictim, the remainder of the pump need not be sterile. However, clean water may be drawn through the bellows. Keep pumping until the clean water has thoroughly flushed out the bellows.

Application: TIME: 3 hrs 30 min

Interspersе throughout lesson. __2 INSTRUCTORS ARE REQUIRED__

Evaluation: TIME: 5 min

Intersperse throughout lesson

CONCLUSION TIME: 5 min

Summary: Today we have covered artifial respiration, inhalation procedures and aspiration procedures.

Remotivation: It is very important to apply these procedures correctly because a life will depend on you.

Assignment: Read and study SG unit 213, Cardiopulmonary Resuscitation and answer the questions at the end of the unit.

Closure: That ends our lesson for today.

CARDIOPULMONARY RESUSCITATION

INTRODUCTION

TIME: 5 min

Attention: What is cardiopulmonary resuscitation? Do you know?

Review: The previous few days have been spent on various subjects that will help you take care of yourself and aid you in saving other lives.

Overview: Now we are going to discuss the one and two man CPR.

Motivation: A person can die very quickly without the proper care. You, as a rescueman, may need to provide the necessary life giving CPR.

Transition: Now we will discuss the perform CPR.

BODY

TIME: 3 hrs 50 min

Presentation:

TIME: 45 min

1. Given a resuscitation manikin, demonstrate procedures for administering cardiopulmonary resuscitation. Procedures must be in accordance with the American Heart Association requiring assistance from the instructor on the difficult parts.

Energy and Training Material Conservation

Conservation of Cleaning Material

American Heart Association Pamphlet

Transparencies Set #213

Resuscitation Manikins

a. Heart problems

(1) Heart disorders

(2) Heart attacks

(3) Symptoms of heart attack

(4) Care for a heart attack

(5) Chest pain

(6) Heart failure

(7) Symptoms of heart failure

(8) Care for heart failure

(9) Hypoxia

(10) Asphyxia

(11) Signs of cardiac arrest

b. Procedures for CPR with one rescueman

(1) Unresponsiveness

(2) Open airway, establish breathlessness

(3) Start ventilations (average 4)

CHECK PULSE

(4) Circulate - 15 compressions to two ventilations, for four cycles

(5) Check pulse

(6) Proceed at a rate of 15 compressions to two ventilations

c. Procedures for CPR with two rescuemen

(1) Same as for one man

(2) Ventilations - interpose one breath on every fifth upstroke

(3) Compress - 60 per minute

d. Procedures for CPR with infants

(1) Two fingertip compressions located between nipple line - center of sternum

(2) Compression ratio - 80-100 times per minute

(3) Ventilation - small puffs from cheeks after every fifth compression

e. Complications with CPR

(1) Hand too high

(2) Hand too low

(3) Hand too far right

(4) Hand too far left

Application:

TIME: 3 hrs.

Intersperse throughout lesson.

2 instructors are required

Evaluation: TIME: 5 min

Intersperse throughout lesson.

CONCLUSION

Summary: We have discussed pulmonary and cardiopulmonary resuscitation today.

Remotivation: As a firefighter, you must know these techniques to perform your job properly.

Assignment: Read and study the following SG units and answer the questions at the end of each unit.

1. SG-301, Block III and IV Orientation.
2. SG-302, Operations, Maintenance and Mounted Equipment on the P-10 Rescue Vehicle.

Closure: Only continued training will keep you proficient in pulmonary and cardiopulmonary resuscitation.

INITIATE MEASUREMENT TEST AND TEST CRITIQUE.

PREPARE THE MAN STUDY GUIDE 3ABR57130-1-SG-200

Technical Training

Fire Protection Specialist

17-2

BLOCK II
BREATHING APPARATUS, RESCUE CARRIES, AND EMERGENCY FIRST AID

2 July 1975

CHANUTE TECHNICAL TRAINING CENTER (ATC)

This supersedes 3ABR57130-1-SW-200, 25 February 1971.
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BLOCK II ORIENTATION

OBJECTIVES

After completing this study guide and your classroom instruction, you will participate in a discussion consisting of questions and answers on:

1. Block content.
2. Safety.
3. Energy conservation.

INTRODUCTION

As a highly trained firefighter, you must not only be able to effect a safe, quick rescue, but also be able to diagnose and give proper first aid treatment for all types of injuries until qualified medical help can be obtained. During the next six days, you will study extensively within the area of first aid and expand your knowledge of this subject. You will also learn about breathing apparatus. This is important to you as a firefighter. You will also study about rescue carries and how to use them.

INFORMATION

BLOCK CONTENT

Block II is six days in length and will include such subjects as breathing apparatus and rescue carries, but will be devoted primarily to first aid. During the learning process, you will be evaluated and graded on your ability to perform various tasks throughout this block. Upon completion of Block II, you will take a written test. Successful completion of this block is determined by satisfactory performance during classroom activities and a passing grade on the written test.

SAFETY

The word SAFETY is heard so much, you would think that maybe we could do without it once in awhile. And if we suddenly discarded the word and what it means, accidents will still occur. As firefighters, we are definitely concerned with safety....the safety of ourselves and others. Those of us who have never had accidents are not just lucky, we have learned to practice safety in everything we do. We have also learned that practicing safety is not a hard job. We would like to invite you to join us. Practice safety and let's stop accidents.

ENERGY CONSERVATION

Shortly, you will engage in simulated first aid practices. You will be using a lot of equipment that you may or may not have seen before. The equipment is here for you to use, but please be conservative with it. Use what you need but don't be wasteful. We hope that some of the measures that we use to conserve energy can be applied Air Force wide. We invite your suggestions for improvements in the fire protection school to promote energy conservation.

QUESTIONS

Please answer the following questions on a separate sheet of paper.

1. How long will you have to learn the content of Block II?

2. Will you be tested during the block?

3. Why is safety so important?

4. How does energy conservation apply to you as an individual?

REFERENCES

1. AFR 92-1, Fire Protection Program.
2. School Reg 50-18, Orientation For Permanent Party and Student Personnel.

Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-SG-202

BREATHING APPARATUS

OBJECTIVES

After completing this study guide and your classroom instruction, you will be able to:

1. Don and operate breathing apparatus in accordance with technical order data.

2. Inspect and service breathing apparatus in accordance with technical order data.

INTRODUCTION

As a firefighter, your ability to successfully combat fires is dependent upon the type of equipment available to you, and your knowledge of the proper use of this equipment. An important part of this equipment is the breathing apparatus. This equipment is used to protect you when entering atmospheres that are deficient of oxygen or containing gases dangerous to life.

INFORMATION

GENERAL DESCRIPTION AND PROPER UTILIZATION

The breathing apparatus, as used here, is the back-pack type and provides complete respiratory protection in any concentration of noxious gases and other conditions of oxygen deficiency. This equipment consists of a facepiece, flexible hose, demand regulator, and cylinder containing air under pressure. Air is delivered through the demand regulator which adjusts the amount of air to suit the wearer's needs either at rest or under exertion. This equipment is easy to don and quickly put into operation by means of a shutoff valve. The unit weighs approximately 30 pounds and will provide approximately 30 minutes of operating time. Figure 1 shows the names and components of the breathing apparatus.

Components

The major component parts of the breathing apparatus are:

1. Air cylinder.
2. Regulator hose.
3. Cylinder valve and safety chain or pin locking device.
4. Air cylinder pressure gauge.
5. Regulator pressure gauge.
6. Shutoff valve.
7. Bypass valve.
8. Facepiece.
9. Breathing tube.
10. Harness and backplate assembly.

Operating Procedures

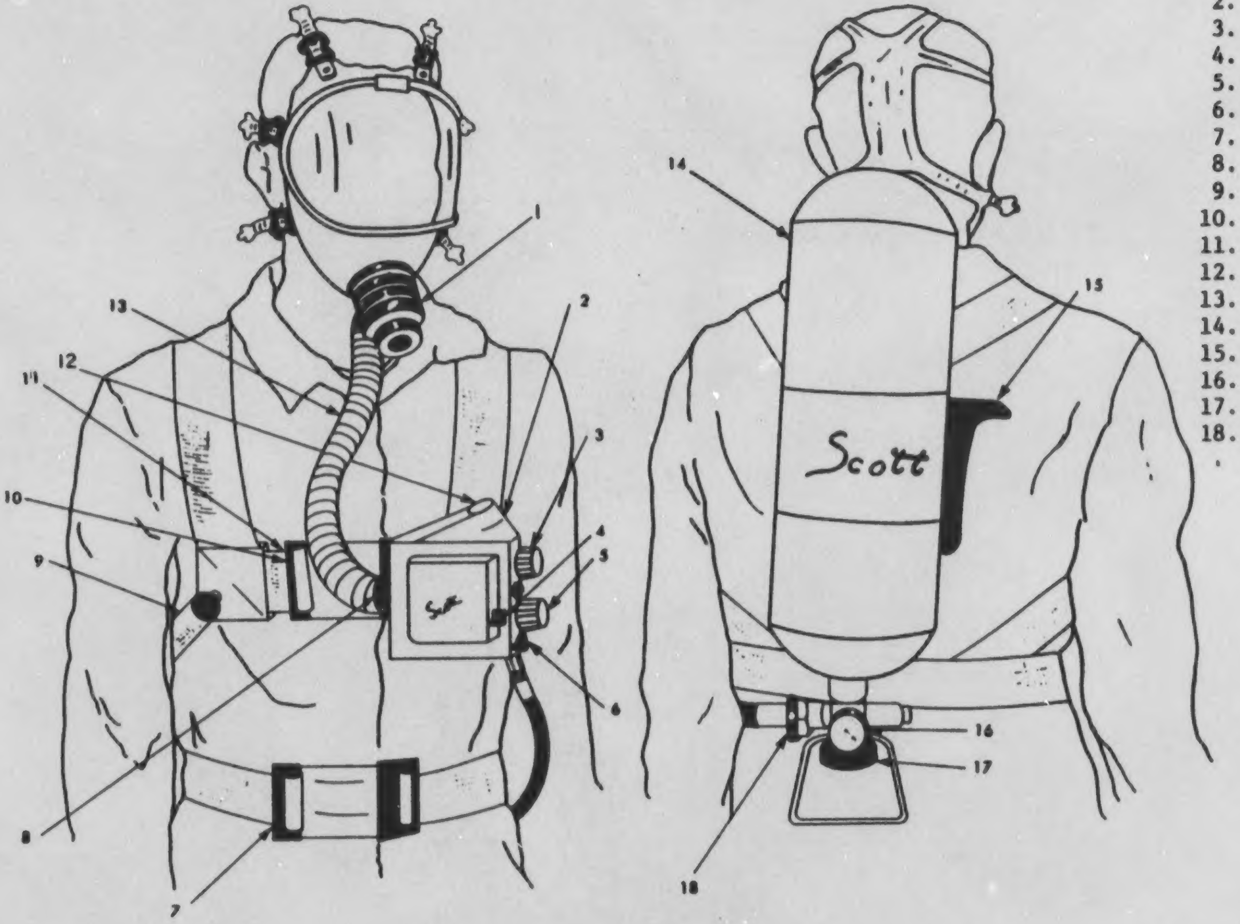
Use the following procedures in operating the air mask.

1. Remove the mask from the carrying case and check the air cylinder tank pressure gauge for "full" indication, or 1980 psi.

2. Then check the regulator shutoff valve (yellow knob) for the full open position.

3. Check the bypass valve (red knob); turn the knob clockwise to the closed position.

4. Turn the cylinder valve a minimum of three full turns, hook the safety chain or pin locking device. Check regulator pressure gauge, which should read the same as the air cylinder pressure gauge (if not, use lower reading for working time). Open the



1. Mask Exhalation Valve
2. Regulator
3. By Pass Valve
4. Control Lever
5. Shut Off Valve
6. Locking Tab
7. Waist Strap
8. Quick Connect Coupling
9. Side Strap
10. Chest Buckle Plate
11. Chest Strap
12. Regulator Pressure Gauge
13. Breathing Tube
14. Air Cylinder
15. Cylinder Clamping Lever
16. Cylinder Pressure Gauge
17. Cylinder Valve
18. Regulator Hose Coupling

SCOTT AIR PACK

Figure 1. Self-Contained Breathing Apparatus.

bypass valve slightly to check the air flow. After air flow has been established, close bypass valve.

5. To don the air pack, put the harness on as if it were a coat, Lean forward slightly, fasten the chest strap, adjust the side straps, then straighten up and fasten the waist buckle.

6. Put on the face mask, placing chin in first and pull the straps over your head. Tighten the straps starting with the neck straps and proceed upward until all straps are snug.

7. Check the mask for leaks by holding the thumb over the breathing tube and inhale slowly. The mask should collapse against the face if there is no leak. Again, holding your thumb over the breathing tube, exhale in order to check the exhalation valve. The air should then escape freely.

8. Do not connect breathing tube to the regulator until you are ready to enter a contaminated area, then connect only finger tight. Check regulator pressure gauge; it should read full; this will operate the mask for 30 minutes. Check the regulator gauge at frequent intervals while in a contaminated area in order to determine the quantity of air remaining. When the regulator gauge indicates 300 psi or is on the heavy line, approximately four minutes air supply remains. You should leave the contaminated area immediately. After leaving the contaminated area, disconnect the breathing tube and remove mask.

Note: Operation of the unit during emergency conditions is as follows: (see figure 1)

1. If the regulator assembly (2) becomes damaged or inoperative, open the bypass knob (3).

2. Then depress the locking tab (6) and close the shutoff valve (5).

3. Adjust the bypass valve (3) to suit your breathing requirements.

4. Then leave the contaminated area.

5. After leaving the contaminated area, remove the unit.

6. Tag the unit for repair.

Care of Equipment After Use

1. To restore the mask to operation after use, wash the facepiece in warm water and mild soap. To disinfect the mask, use 70% ethyl alcohol, rinse, and air dry. Wipe off any other accumulation of dirt, etc., from the rest of the equipment with a clean cloth.

2. Make sure all components of the equipment are dry before returning them to the carrying case.

INSPECTION AND PREVENTIVE MAINTENANCE OF THE BREATHING APPARATUS

The breathing apparatus is visually inspected daily and after each use. A complete operational test and inspection is required quarterly (90 days).

Daily and After Operation

The following list of items should be checked when performing a visual daily or after operation inspection.

1. Case: Check the condition of the case.

   a. Handle.

   b. Snaps.

   c. Wrench.

2. Facepiece: Check each of the following items on the facepiece to see if they are complete and in good condition.

   a. Lens.

   b. Exhalation valve.

   c. Headstraps.

   d. Face seal.

3. Regulator Assembly: Inspect each of the following:

   a. Shutoff valve (yellow knob, full open).

b. Bypass valve (red knob, closed).

c. Gauge.

d. Hose.

e. Threads.

4. Cylinder: Check the following:

a. Pressure (if not full, recharge, or replace).

b. Valve (closed).

c. Safety chain or pin locking device.

5. Harness: Inspect the following items on the harness:

a. Webbing.

b. Buckles.

c. Snaps.

d. Shoulder pads.

Changing Cylinders

When the cylinder requires exchange or recharging, follow these procedures:

1. Make sure the cylinder valve is closed.

2. Remove the regulator hose from the cylinder using the wrench located in the case.

3. Push the release lever to remove the cylinder from the backplate.

4. Reverse the above procedures to install a full air cylinder.

5. Wipe the entire assembly off to remove dirt and other foreign matter.

STORING THE UNIT

Store the unit in the carrying case with the backplate up and fold the harness over the cylinder. Arrange the regulator hose so it will not be sharply bent or cramped. Place the mask and breathing hose in the case loosely.

QUESTIONS

Answer questions on a separate sheet of paper. The answers will be checked and evaluated by your instructor. Do not write in this book.

1. What is the primary purpose of breathing apparatus?

2. Where is the breathing apparatus stored when not in use?

3. When should the breathing apparatus be inspected?

4. What should the air pressure gauge read with a full cylinder?

5. How is the facepiece checked to ensure there are no air leaks?

6. What is the working time of the breathing apparatus?

7. How many times should the cylinder valve be turned before use?

8. When will the bypass valve be opened?

9. What is used to disinfect the breathing apparatus mask?

REFERENCES

1. AFR 92-1, Fire Protection Program.

2. TO 14S5-7-1, Self Contained Breathing Apparatus.

Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-SG-203

RESCUE CARRIES

OBJECTIVE

After completing this study guide and your classroom instruction, you will be able to identify the proper rescue carries to use when confronted with a rescue situation. Perform rescue without causing further injury to the victim.

INTRODUCTION

The Air Force does not need special rescue and ladder companies in its fire departments as large metropolitan areas do. Air Force bases are much smaller than these cities and can, therefore, combine several firefighting duties. However, for better organization, specific individuals or crews may be assigned the primary job of rescue, local conditions permitting. Normally, each Fire Protection Specialist in the Air Force is a rescueman as well as a firefighter. But you, the firefighter, cannot wait until the need arises before you learn how to rescue building occupants. You must know in advance what is to be done, what tools you will use, and how you will use them. We've mentioned before that saving lives and property is the goal and purpose of the firefighter. Lives are certainly more important than property; therefore, rescue efforts come before anything else. The senior officer's size-up of the emergency should tell if rescue operations will be required. Extreme care should be taken in moving building occupants who appear to be injured. Inexperienced handling may greatly aggravate injuries. Compound fractures may be transformed into more serious, or even fatal injuries, unless removal is accomplished in the proper manner. When a fire is not serious or is under control, and required medical aid is at hand, rescueman's immediate removal of injured personnel may not be desirable. In any case, medical assistance should be available at the earliest possible time. The removing and handling of deceased personnel may not be desirable. In any case, medical assistance should be available at the earliest possible time. The removing and handling of deceased personnel should be left to medical personnel except when necessary to save the bodies or entry is too hazardous for any but trained firefighters. With this in mind, let's get into our discussion of rescue techniques, operations, and transportation of victims.

INFORMATION

RESCUE PLANNING

Senior Officer

The senior officer in charge at the scene of the fire will direct the rescue operation. He will direct you and your fellow firefighters to effect the rescue and to control the fire.

Hose Streams as a Rescue Aid

A hose stream or a "water curtain" will prevent backdrafts, open paths, cool personnel, extinguish or knock down fire, dilute the concentration of smoke, and in general, give considerable help.

Entering and Leaving the Building

The breathing apparatus allows the rescue personnel to enter dangerous, smoke-laden areas. They can search for the victims in comparative safety to themselves and effect rescue much more rapidly with the breathing apparatus. Inside stairways, if not cut off by fire, offer the safest route of rescue because the smoke only obscures the vision. Before the rescueman enters a building, he should have a lifeline attached to him in case of any eventuality. The lifeline will lead others to him, and by the same token, it will lead him back to his starting point. Many times the planned escape routes are cut off by fire, and windows offer the only path to safety. For this reason, you'll find yourself placing ladders at window openings where trapped victims may be. To assist a victim down a ladder, the rescueman merely precedes the victim down the ladder. The victim descends between the arms of the rescueman.

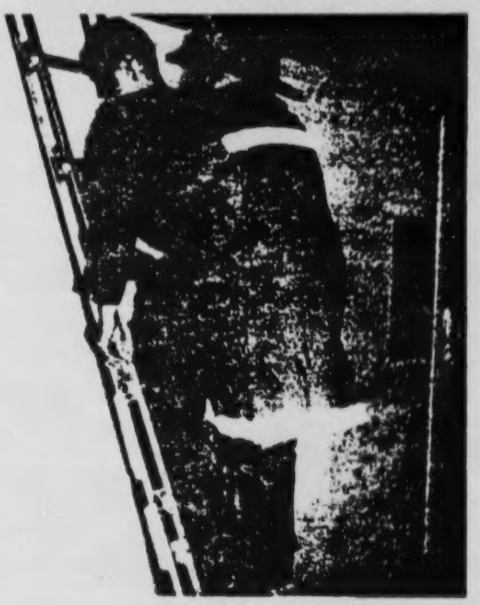


Figure 2. Using Ladder to Aid in Rescue.

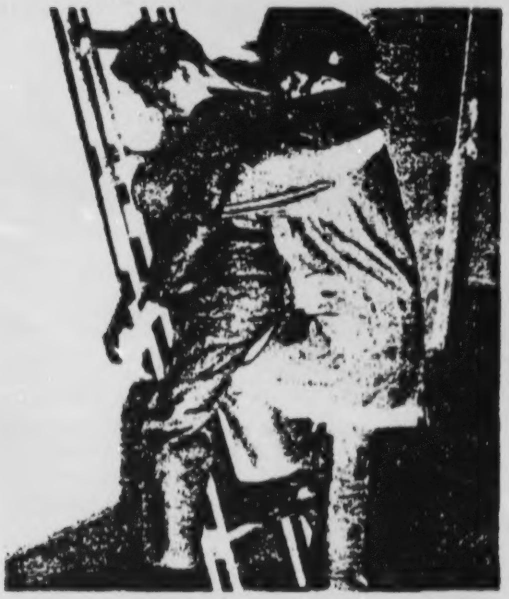


Figure 3. Using Ladder to Aid in Rescue.

Removing the Victim

If the victim becomes unable to proceed, the rescueman puts him astride his knee and cautiously makes his way down the ladder, figures 2 and 3. Also, the victim can be lowered by use of the rescue tie (bowline on a bight/double bowline) or on a stretcher to which he can be securely strapped. Such a stretcher can be improvised in emergencies by using the 14-foot ladder. While the rescue is being attempted, other firefighters will be directed to position hoselines and equipment, both to assist in the rescue and to begin controlling the fire. Hoselines are placed in readiness first. This is for the protection of victims and firemen.

Reading Assignment

To learn the various rescue carries and the proper methods of victim removal from endangered areas, read this study guide and the following: American National Red Cross First Aid Manual, pages 110 through 112, and IFSTA 109, Chapter 15, pages 225 through 247.

RESCUE CARRIES

The method of removing a victim from a danger area is governed by conditions and personal preference. The decision is made by you, often under duress, and with little time to think. If you are experienced in all types of carries, you will make the right decision.

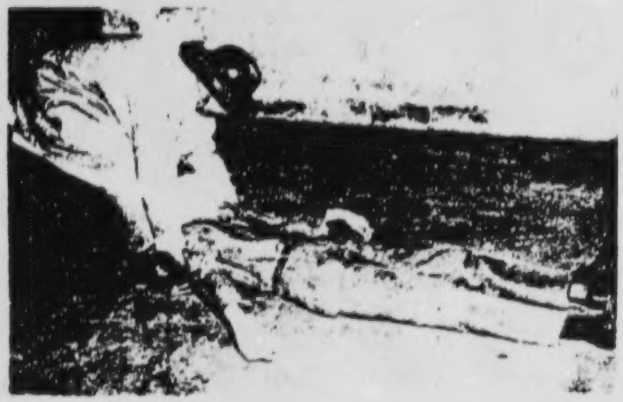
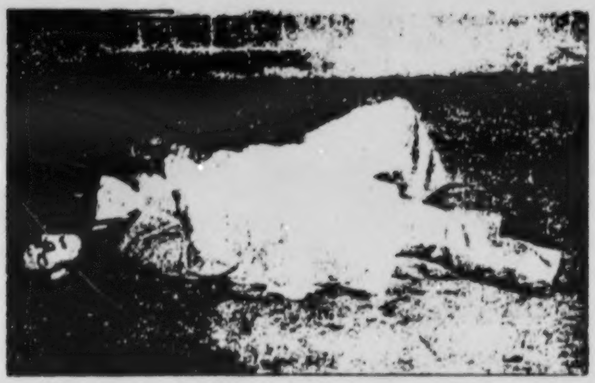


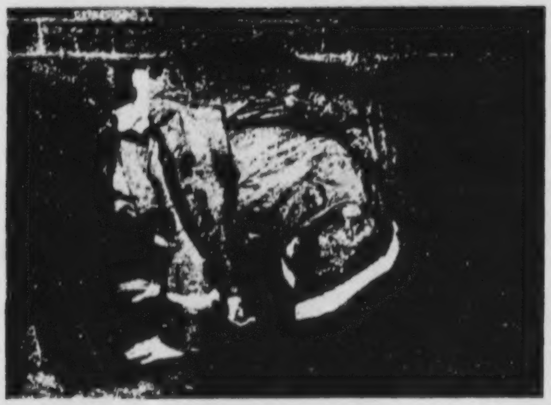
Figure 4. Drag.

Drag

The drag is used when the victim is near an exit, when the victim is



Step 1.



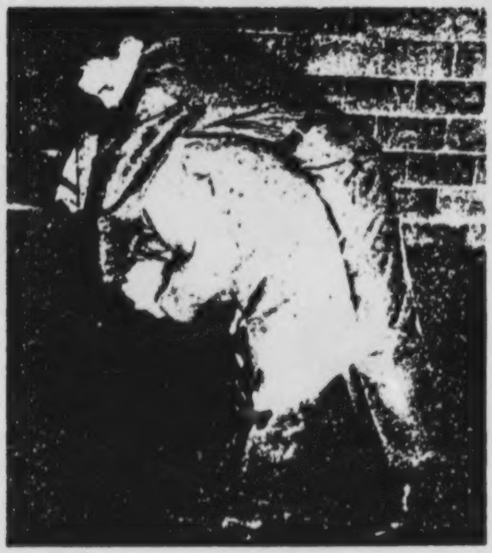


Figure 5. Backstrap Carry.

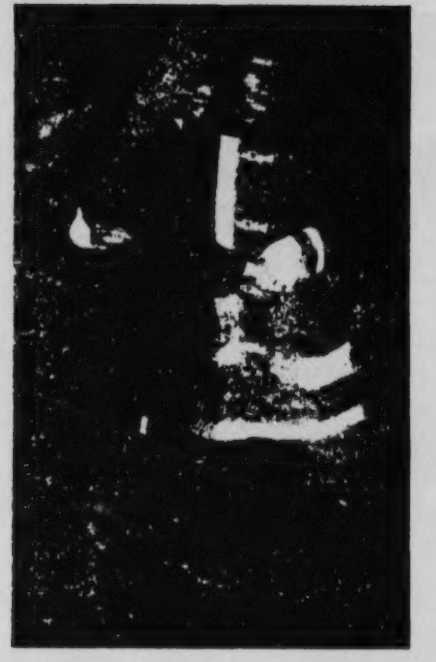
extremely heavy, or where lack of headroom makes other carries impractical, figure 4. Place the victim on his back, grasp him beneath the arms, and moving backward, drag him to an area of safety.

Backstrap Carry

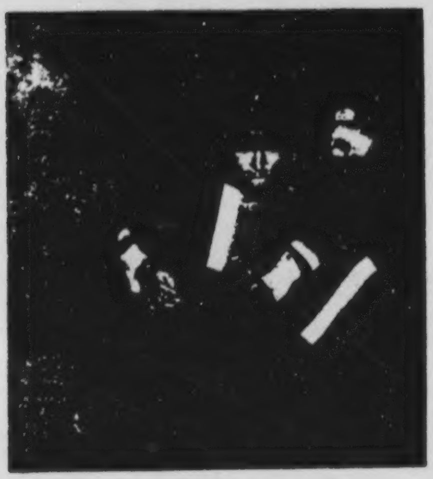
This carry is valuable if the victim's injuries will permit its use and the victim's weight is equal to or less than that of the rescueman. If the victim is lying down and cannot help, the rescueman must also lie down with his back against the victim's chest. In this position, reach over the victim and bring his top arm over your shoulder and hold it in place with your hand close to your chest. As shown in Step 1 of figure 5, you grasp the clothing of the victim at his hip with the other hand and roll him over on top of you. From this position, get on both knees,

Step 1

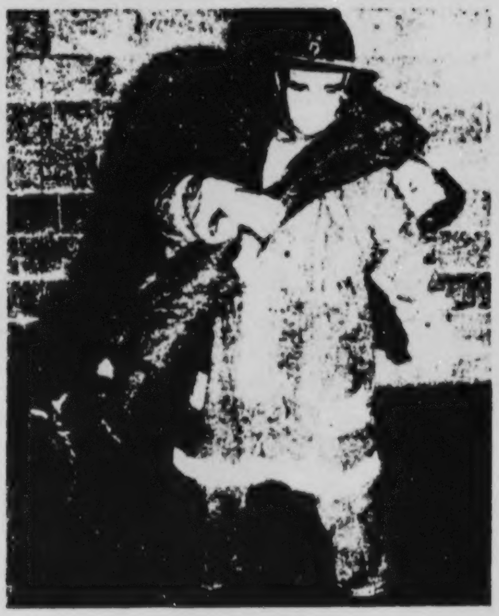
Step 2



Step 3



Step 4



Step 5

Figure 6. Fireman's Carry.

see Step 2. Then to one knee. Then stand upright, as shown in Step 3.

Fireman's Carry

Victims of smoke or heat are generally found lying on the floor. If the victim is not already in the facedown position, turn him over, supporting his head on his arm, as shown in Step 1 of figure 6. Straddle the victim, place your hands under his armpits, and lift him to a standing position, see Step 2 of figure 6. Support the man with your arm around his waist and step in front of him, and grasp the victim's right wrist with your left hand, as shown in Step 3. Bending your knees enough to locate your right shoulder against his midsection, pull his right arm around the back of your neck so that the victim's body drapes across your shoulders. Slip your right arm between his knees and bring his right arm down to your right hand and grasp it firmly by the wrist with your right hand, see Step 4. You are now ready to stand. As shown in Step 5, you now lift straight up, using your leg muscles to prevent injury to yourself. This carry enables the rescueman to carry the victim a considerable distance without fatigue. Another distinct advantage of this carry is that the rescueman will have his left hand free for protection and for moving obstructions.

Arms Carry

The arms carry is recommended for carrying the victim for short distances. The victim is grasped under the back with one arm and the knees with the other arm, figure 7. He is carried high to decrease the fatigue rate of the rescuer. The arms carry is not recommended when the man has a broken back or leg.

Seat Carry

This is a two-man carry which merely consists of carrying the victim on a "seat" provided by the rescuemen's arms. See figure 8. Step 1 shows how the seat is formed and step 2 shows the victim in place.

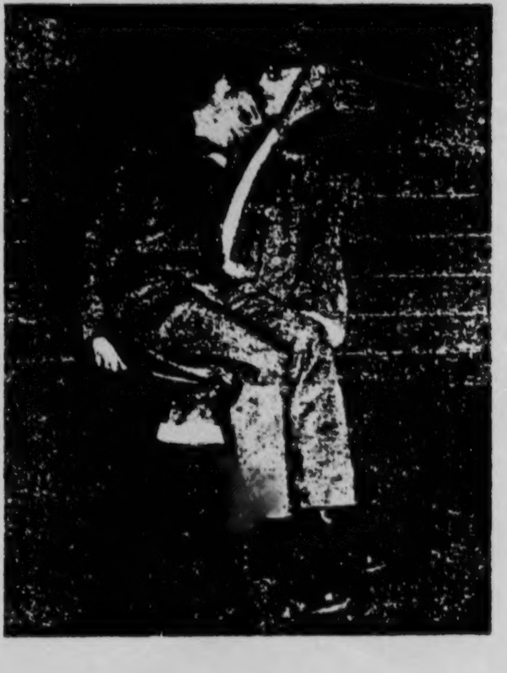


Figure 7. Arms Carry.

Chair-Litter Carry

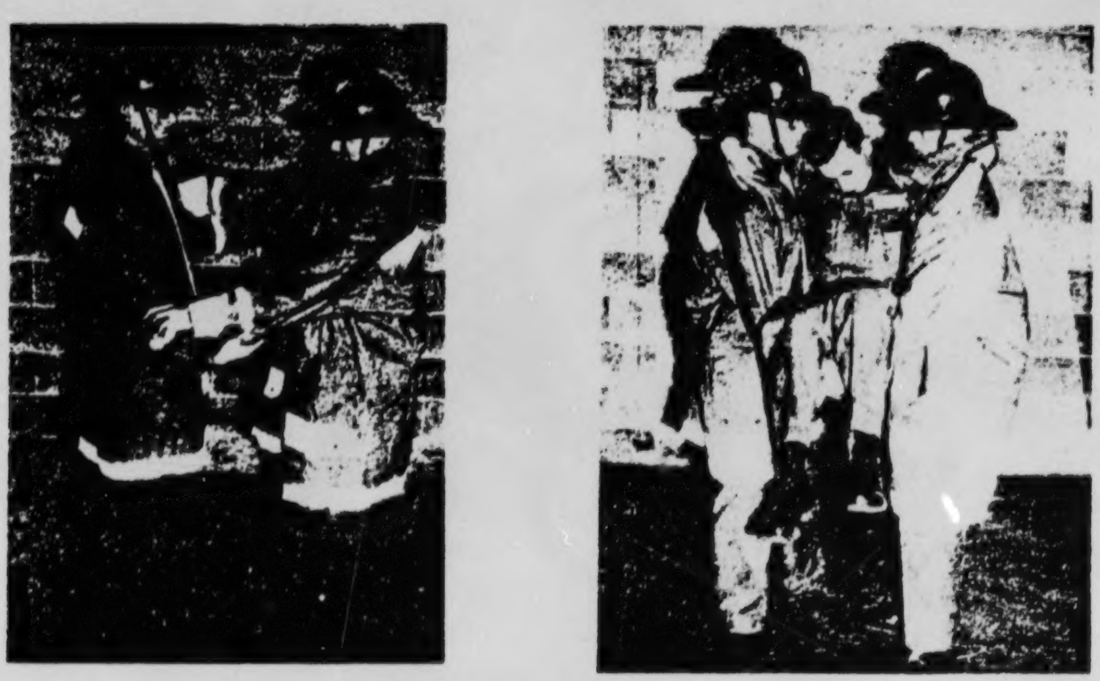
A convenient technique for carrying a person when a litter is not available is to seat the victim on a strong chair, figure 9. This is also good for going up and down stairs, through narrow corridors, etc.

Carry by Extremities

The chief use of the carry is for moving victims that have no serious injuries to the body. One rescueman grasps the victim by the legs and the other rescueman grasps the victim under the arms and around the chest, as shown in figure 10.

Three-Man Carry

In case of severe injuries the number of rescuers should be increased to at least three. This procedure makes it possible to transport a victim with the least possible bending or twisting of his body. One of the group must be in command in order to coordinate the group efforts. It is common practice to make the one at the victim's head



Step 1.

Step 2.

Figure 8. Seat Carry.

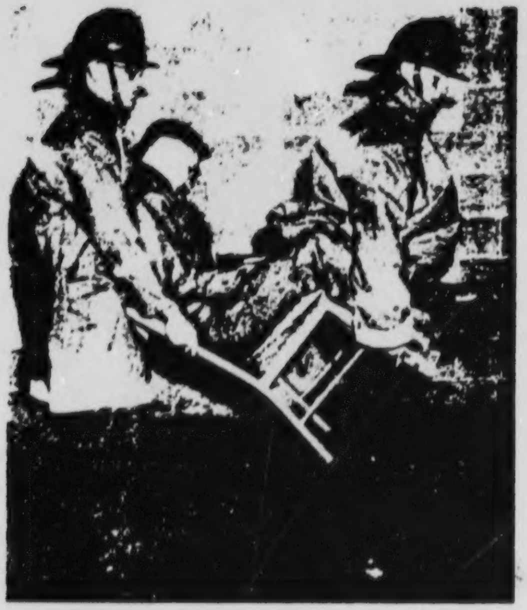


Figure 9. Chair Litter Carry.

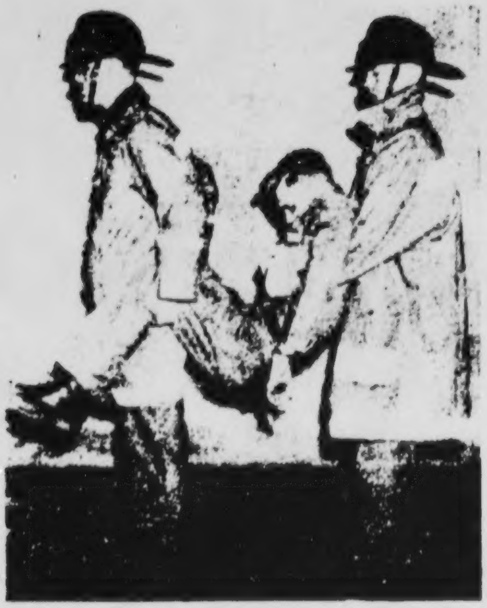
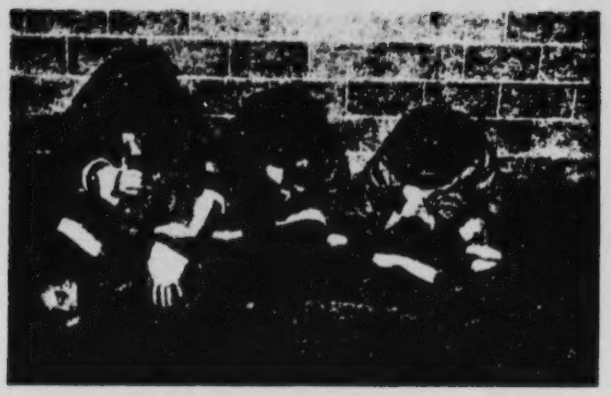
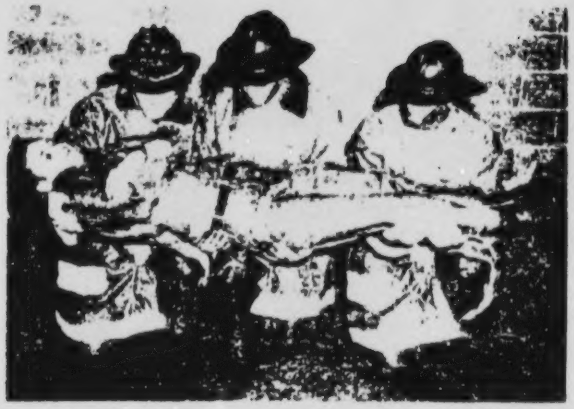


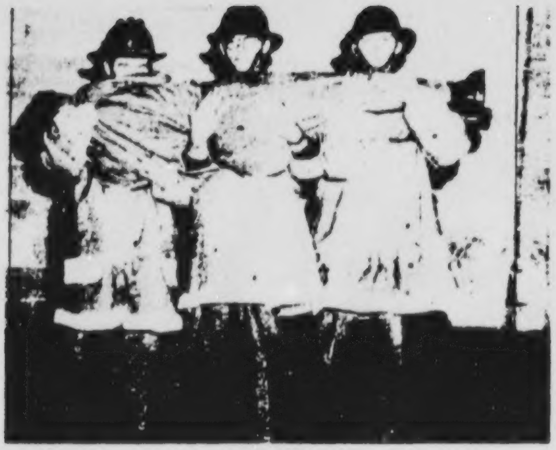
Figure 10. Carry by Extremities.



Step 1.

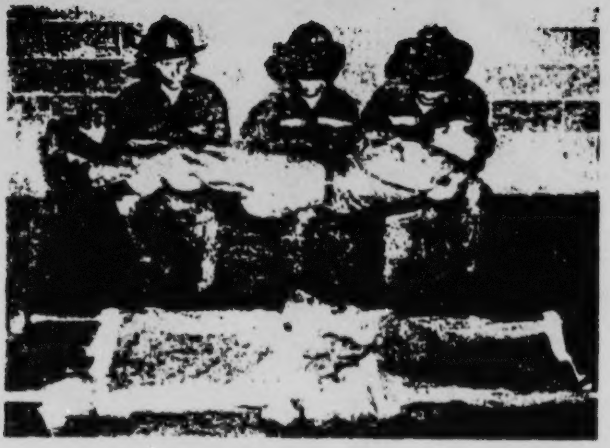


Step 2.

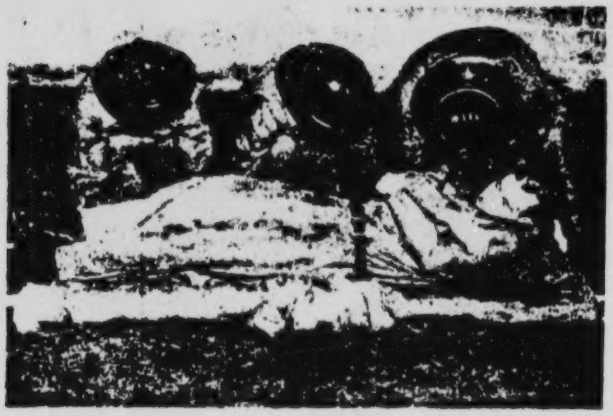


Step 3

Figure 11. Three-Man Carry.



Step 1.



Step 2.

Step 3.

Figure 12. Stretcher Carry.

the leader of the crew. Three rescuemen line up on one side of the victim and the leader gives the word "prepare to lift." As shown in step 1 of figure 11, each man kneels on the knee nearest the victim's feet, so that one man is at his shoulders, one at his hips, and one between his knees and feet. Each man places his hands and forearms under the victim. The man at the victim's head places his hands under the shoulders, the center man places his hands under the pelvis or hips and the small of the back, and the third man places his hands under the knees and ankles. As shown in step 2, at the command to lift, the rescuemen raise the victim and place him on their knees without releasing their hands. At the command "raise" all rescuemen raise slowly to the standing position, and hold the victim closely against their chests. See figure 3. A victim may be lowered by reversing the operation, but always at the command of the leader.

Stretcher Carry

As shown in steps 1 and 2 of figure 12, the procedure for placing a victim on a stretcher is the same as preparing to lift on the three-man carry. Although a stretcher squad should consist of four men, two or three men may carry a stretcher under certain circumstances. If three men are to carry a stretcher, their positions are, one at each end of the stretcher, and one at the middle, and all facing the same direction. The stretcher must be picked up in this position since there is no help available for the lead man to turn around after the stretcher is raised. See step 3 of figure 12. The lead man and the rear man should walk out of step to eliminate bouncing the victim.

PRACTICAL EXERCISES

The remainder of your training in the rescue phase will be to compare your proficiency in the tasks you have been reading about. These drills are designed to closely parallel the real situation you will encounter in the field.

While engaged in rescue:

1. Do not lift any object or person that is in excess of your own weight.

2. Do not attempt to climb up or down ladders or stairs using other students or instructors as simulated victims.

3. Do not enter smoke-filled buildings except when accompanied by an instructor.

4. Walk at all times and grasp hand rails when descending or ascending smoke tower steps.

5. Be especially careful when ice is present in the training area.

6. Report equipment defects immediately.

QUESTIONS

Answer questions on a separate sheet of paper. The answers will be checked and evaluated by your instructor. Do not write in this book.

1. What crewmembers perform rescue in a USAF fire department?

2. What is of paramount importance in the moving of injured personnel?

3. When and by whom should deceased personnel be moved?

4. Conditions permitting, what is the safest route to use in moving victims down and out of a multiple story building?

5. Why is the victim carried "high" when using the arms carry?

6. Describe the "carry by extremities."

7. When using the three-man carry, and the command "Lift" is given, in what position is the victim placed?

8. When using three men to move a victim on a stretcher, what are their positions?

9. What is the advantage of using a lifeline in rescue operations?

10. How are hose streams used to aid rescue operations?

11. When are ladders used in a rescue operation?

12. Which carry is used to decrease bending and twisting of the victim's body?

13. Which carry is practical, other conditions permitting, when moving an extremely heavy person?

14. What safety factors are involved when lifting a victim?

15. Describe how you would assist a victim down a ladder.

16. You need a stretcher but there is none available. How can you improvise one with your structural equipment?

REFERENCES

1. The American National Red Cross First Aid Manual.

2. IFSTA #109, Fire Service First Aid Practices.

Fire Protection Branch
Chanute AFB, Illinois

INTRODUCTION TO FIRST AID

OBJECTIVES

After completing the study guide and your classroom instruction, you will be able to:

1. Identify the purpose of first aid.

2. Demonstrate the procedures for checking victims for injuries.

INTRODUCTION

First aid is the immediate care given to a person who has been injured or has been suddenly taken ill. It includes self-help and home care if medical assistance is not available or is delayed. It includes well-selected words of encouragement, evidence of willingness to help, and promotion of confidence by demonstration of competence.

Reading Assignment

To understand and learn the purpose of first aid, read Chapter 1, pages 11 through 17, in The American National Red Cross First Aid Manual and pages 1 through 6 in IFSTA Manual #109.

QUESTIONS

Answer questions on a separate sheet of paper. The answers will be checked and evaluated by your instructor. Do not write in this book.

1. First aid knowledge and skill often means ____________________.

2. First aid training is of value in ____________________.

3. Name two (2) reasons why first aid training is needed.

4. First aid training promotes safety awareness. What are the three closely related terms needed to promote awareness?

5. Name three values of first aid training.

6. List three procedures that should be carried out as additional first aid directions.

7. What are the procedures listed under "carry out the indicated first aid"?

REFERENCES

1. American National Red Cross First Aid Manual.

2. IFSTA #109.

IDENTIFICATION AND TREATMENT OF SHOCK

OBJECTIVE

After completing this study guide and your classroom instruction, you will be able to demonstrate procedures to prevent or reduce shock.

INTRODUCTION

Shock is a condition resulting from a depressed state of many vital body functions, a depression that could threaten life even though the victim's injuries would not otherwise be fatal. Injury-related shock, commonly referred to as traumatic shock is decidedly different from electrical shock, insulin shock, and other special forms of shock.

Reading Assignment

To obtain a basic understanding of shock, its causes and treatment, read Chapter 4, pages 60 through 65, in The American National Red Cross First Aid Manual.

QUESTIONS

Answer questions on a separate sheet of paper. The answers will be checked and evaluated by your instructor. Do not write in this book.

1. What is injury-related shock commonly referred to?

2. What may cause shock?

3. State the signs and symptoms of shock.

4. List the treatment objectives of shock.

5. List the steps for preventing shock.

6. Why is body position vital in treatment of shock?

7. How do you regulate body temperature?

8. Name two procedures in administering fluids to a victim suffering from shock.

REFERENCE

1. American National Red Cross First Aid Manual.

Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-SG-206

SWALLOWED OBJECTS AND CHOKING

OBJECTIVE

After completing this study guide and classroom instruction, you will be able to administer emergency first aid treatment for swallowed objects and choking.

INTRODUCTION

Each year nearly 2,000 deaths occur in the United States due to asphyxia caused by obstruction of breathing. Two-thirds of the deaths reported apply to children under the age of 4 years.

Reading Assignment

To learn the causes and treatment of swallowed objects and choking, read Chapter 6 pages 90 through 94, American National Red Cross First Aid Manual.

QUESTIONS

Answer the questions on a separate sheet of paper. The answers will be checked and evaluated by your instructor. Do not write in this book.

1. How does a small child investigate small objects?

2. Name the signs and symptoms of swallowed objects and choking.

3. Name the objective of first aid treatment for swallowed objects.

4. Name the steps for prevention of swallowed objects and choking for small children.

5. Name the steps for prevention of swallowed objects and choking for older children and adults.

REFERENCE

1. American National Red Cross First Aid Manual.

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Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-SG-207

POISONING AND DRUGS

OBJECTIVES

After completing this study guide and your classroom instruction, you will be able to:

1. Identify procedures for administering emergency first aid for poisoning.
2. Identify procedures for emergency first aid treatment for drugs.

INTRODUCTION

A poison is any substance, solid, liquid, or gas, that tends to impair health, or cause death when introduced into the body or onto the skin surface.

Administered under medical direction, drugs often appear to have miraculous effect in relieving suffering, combating disease, and saving life. When the same drugs are misused or abused, they can become enemies.

Reading Assignment

To understand the signs, symptoms and treatment for poisoning and drugs, read Chapters 7 and 8 in the American National Red Cross First Aid Manual.

QUESTIONS

Answer questions on a separate sheet of paper. The answers will be checked and evaluated by your instructor. Do not write in this book.

1. What is the definition for drug misuse as stated in Chapter 8?
2. What is the definition for drug abuse as stated in Chapter 8?
3. Why are small children likely to become poisoning victims?
4. What are the aids in determining whether or not a victim has swallowed poisons?
5. What is the objective in treatment of poisoning by mouth?
6. What is the first aid treatment for minor bites and stings?
7. What is the proper way to make incisions (cuts) over the fang punctures in snake bites?

REFERENCE

1. American National Red Cross First Aid Manual.

Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-SG-208

IDENTIFICATION AND TREATMENT OF WOUNDS

OBJECTIVE

After completing this study guide and your classroom instruction, you will be able to demonstrate procedures for the prevention of contamination and control of bleeding.

INTRODUCTION

A wound is a break in the continuity of the tissues of the body, either internal or external. Wounds usually result from external physical forces. The most common accidents resulting in open wounds are motor vehicle accidents, falls, and mishandling of sharp objects, tools, machinery, and weapons.

Reading Assignment

To identify what a wound is and its treatment, read Chapter 2 in the American National Red Cross First Aid Manual.

QUESTIONS

Answer questions on a separate sheet of paper. The answers will be checked and evaluated by your instructor. Do not write in this book.

1. What is an open wound?

2. What is a closed wound?

3. What is an abrasion?

4. What is an incision?

5. What is a laceration?

6. What is a puncture wound?

7. What are the first aid procedures for open wounds?

8. What are the safeguards to use when a dressing has been applied to control bleeding?

9. Why are human bites so dangerous?

REFERENCE

1. American National Red Cross First Aid Manual.

IDENTIFICATION AND TREATMENT OF SPECIFIC INJURIES

OBJECTIVES

After completing this study guide and your classroom instruction, you will be able to:

1. Identify procedures for administering emergency first aid for burns.

2. Identify procedures for administering emergency first aid for frostbite and cold exposure.

3. Identify procedures for administering emergency first aid treatment for heat stroke, heat cramps, and heat exhaustion.

INTRODUCTION

Foreign objects are often blown or rubbed into the eyes. Such objects are harmful not only because of the irritating effect but also because of the danger of their scratching the surface or becoming embedded in the eye.

A burn is an injury that results from heat, chemical agents, or radiation. It may vary in depth, size, and severity, causing injury to the cells in the affected area.

The extent of injury caused by exposure to abnormally low temperature generally depends on such factors as wind velocity, type and duration of exposure, temperature, and humidity. Freezing is accelerated by wind and by humidity or a combination of the two factors. This injury is called frostbite.

Excessive heat may affect the body in a variety of ways which result in several conditions. They are referred to as heat stroke, heat cramps, and heat exhaustion.

Reading Assignment

To better understand what a specific injury is, read Chapters 3, 9, 10, and 11 in the American National Red Cross First Aid Manual.

QUESTIONS

Answer questions on a separate sheet of paper. The answers will be checked and evaluated by your instructor. Do not write in this book.

1. What are the signs and symptoms of foreign objects in the eyes?

2. What are the precautions to prevent injury by foreign objects to the eyes?

3. What are the causes of burns?

4. What are the three degrees of burns?

5. What is the first aid treatment for the three degrees of burns?

    a. 1st degree.

    b. 2nd degree.

    c. 3rd degree.

6. What are the first aid objectives for the treatment of frostbite?

7. What are the signs and symptoms of heat stroke?

8. What are the symptoms of heat cramps?

9. What are the symptoms of heat exhaustion?

REFERENCE

1. American National Red Cross First Aid Manual.

Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-SG-210

DRESSING, BANDAGING AND SPLINTING

OBJECTIVES

After completing this study guide and your classroom instruction, you will be able to:

1. Demonstrate procedures for applying a dressing or bandage.
2. Demonstrate procedures for applying a tourniquet.
3. Demonstrate procedures for administering first aid for fractures.

INTRODUCTION

Techniques of applying dressings and bandages vary according to the extent and location of injuries, the material at hand, and the ability of the first-aider to adapt to an emergency situation.

Multiple injuries to the skeletal system, including the bones, joints, and ligaments, and to the adjacent soft tissues are common in all types of major accidents.

Reading Assignment

To learn what is a bandage and how to apply it, read Chapters 13 and 14 in the American National Red Cross First Aid Manual.

QUESTIONS

Answer questions on a separate sheet of paper. The answers will be checked and evaluated by your instructor. Do not write in this book.

1. When the decision has been made to apply a tourniquet, who makes the decision to loosen or remove it?
2. What goes over a wound first?
3. When is a dressing used?
4. What is a bandage used for?
5. What is a fracture?
6. What is a splint used for?
7. When a person has a fracture of the spine, what is your primary precaution?

REFERENCE

1. American National Red Cross First Aid Manual.

SUDDEN ILLNESS

OBJECTIVE

After completing this study guide and your classroom instruction, you will be able to identify procedures for administering emergency first aid for sudden illnesses.

INTRODUCTION

First aid workers often encounter emergencies that are not related to injury but arise from either sudden illness or a crisis in chronic illness. Unless the illness is minor and brief, such as a fainting attack, air sickness, a nosebleed, or a headache, medical assistance should be sought. Although sudden illness is not always urgent, sometimes it endangers a person's life especially if associated with a heart attack or a massive internal hemorrhage. An important first aid measure in such an instance is to secure transportation for the victim to receive medical care as quickly and safely as possible.

Reading Assignment

To better understand what is meant by sudden illness, read Chapter 12 in the American National Red Cross First Aid Manual.

QUESTIONS

Answer questions on a separate sheet of paper. The answers will be checked and evaluated by your instructor. Do not write in this book.

1. The two principle systems of an acute heart attack are?

2. Where does a stroke occur in the human body?

3. What is fainting?

4. What is convulsions?

5. What is epilepsy?

REFERENCE

1. American National Red Cross First Aid Manual.

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Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-SG-212

RESPIRATORY EMERGENCIES AND ARTIFICIAL RESPIRATION

OBJECTIVES

After completing this study guide and your classroom instruction, you will be able to:

1. Demonstrate procedures for administering artificial respiration.

2. Demonstrate inhalation procedures using resuscitation manikin, resuscitation device, and workbook.

3. Demonstrate aspiration procedures using resuscitation manikin, resuscitation device, and workbook.

INTRODUCTION

A respiratory emergency is one in which normal breathing stops or in which breathing is so reduced that oxygen intake is insufficient to support life.

Artificial respiration is a procedure for causing air to flow into and out of a person's lungs when his natural breathing is inadequate or ceases.

Reading Assignment

To understand what a respiratory emergency is and what first aid measures to take, read Chapter 5 in the American National Red Cross First Aid Manual.

QUESTIONS

Answer questions on a separate sheet of paper. The answers will be checked and evaluated by your instructor. Do hot not write in this book.

1. What is the definition of respiratory emergency?

2. What is the definition of artificial respiration?

3. What are the objectives of artificial respiration?

REFERENCE

1. American National Red Cross First Aid Manual.

Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-SG-213

CARDIOPULMONARY RESUSCITATION

OBJECTIVE

After completing this study guide and your classroom instruction, you will be able to demonstrate procedures for administering cardiopulmonary resuscitation.

INTRODUCTION

Even in this age of highly sophisticated and automated machines, a factory worker must know a great deal more about the machine than the mere fact that it performs a certain function and that a single switch or lever causes it to do its work. He must know how the machine works, and what is more important, what to do if it malfunctions or fails. The same is true of the rescueman. It is not enough for him to know that the human body is a wonderful and complex machine that may operate for years with only minimal care and with a remarkably low breakdown rate. He must know how the machine works and he must know what to do in case any of its major parts malfunction or fail.

The human machine continues to function efficiently because of a close relationship among the heart, the lungs, the brain, and their interconnecting blood vessels. Each of the organs is dependent on the others, and each will continue to function only as long as the others operate properly.

The heart pumps blood to the lungs, where it is combined with oxygen that is drawn into the lungs with each breath. The oxygen-enriched blood returns to the heart and is immediately pumped to all parts of the body where the oxygen is exchanged for waste products (see figure 13).

INFORMATION

CARDIOPULMONARY RESUSCITATION

While all of the cells of the body need a constant and uninterrupted supply of oxygen for nourishment and revitalization, nowhere is this supply more essential than in the brain. In addition to regulating all of the other functions, the brain controls the activity of the heart. As long as the cardiac control center in the brain is properly fueled by a fresh supply of oxygen, it continues to send the signal that causes the heart to pump efficiently and without interruption. Thus, it is quite easy to see that life continues as long as the operation of the heart, lungs, and brain are properly balanced.

On the other hand, if something happens to upset this balance, the body is placed in immediate danger. Unless the condition causing the disturbance is corrected promptly and efficiently, death may result. In many cases, death is expected and is inevitable. For example, advanced age coupled with terminal illnesses may cause the cells of vital organs to deteriorate to the point where they simply can no longer function, and the body dies. On the other hand, the sudden and unexpected death of an otherwise healthy person might be reversed if the proper resuscitative steps were taken immediately. Such as the case of victims drowning, electric shock, heart attack, asphyxia, or similar accidents.

In many accident situations, the chain of events that leads to death is initiated by the inability of the patient to breathe. Since no fresh air is provided to the lungs, no oxygen supply is available to the blood stream. Even though the heart continues to pump, no oxygen is carried to the cells of the brain. The brain cells are weakened by the lack of fuel, and the cells that make up the cardiac control center quickly lose their ability to send signals to the heart. Because it

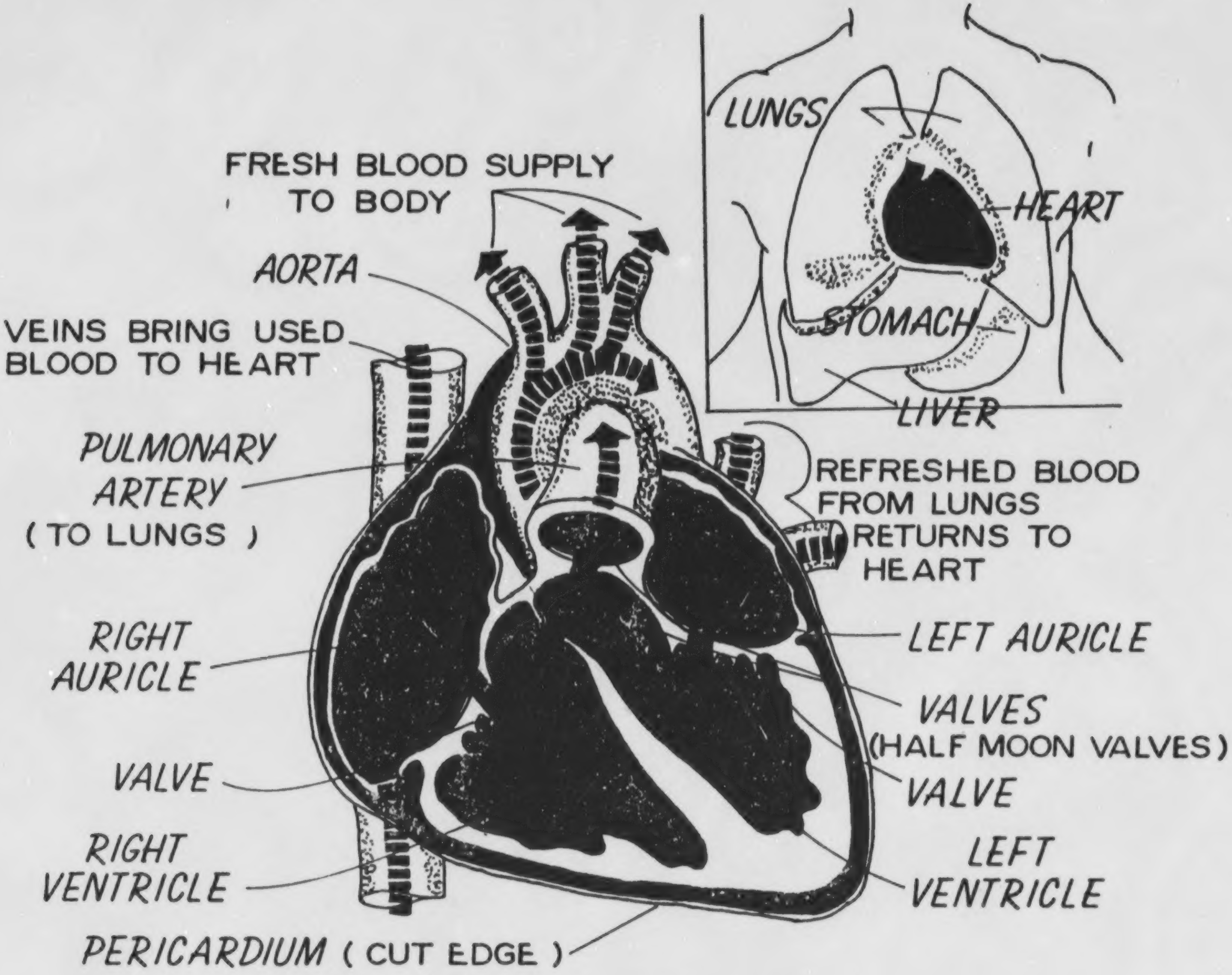
LUNGS
HEART
STOMACH
LIVER
FRESH BLOOD SUPPLY TO BODY
AORTA
VEINS BRING USED BLOOD TO HEART
PULMONARY ARTERY (TO LUNGS)
REFRESHED BLOOD FROM LUNGS RETURNS TO HEART
RIGHT AURICLE
LEFT AURICLE
VALVES (HALF MOON VALVES)
VALVE
VALVE
RIGHT VENTRICLE
LEFT VENTRICLE
PERICARDIUM (CUT EDGE)

Figure 13. The Human Heart.

	Symptom	Treatment
PAIN	Severe pain in chest radiating to shoulder, arm, and hand.	Assists victim to take medication if under a doctor's care, otherwise carry out the steps below.
RESPIRATION	Shortness or basence of breath is a very severe and dramatic symptom.	Maintain open airway, artificial respiration, 100% oxygen.
UNCONSCIOUSNESS	May occur at the outset or later in the attack.	Maintain open airway. Artificial respiration may be indicated - administer 100% oxygen.
CYANOSIS	Very possible, but not necessarily present.	See respiration.
APPREHENSION AND FEAR	Present - patient has feeling that death is impending.	Reassure victim, keep him quiet. Note: Keep him still and quiet.
SHOCK	All symptoms may be present.	Treat for shock. Make comfortable, reassure victim. Note: Keep in sitting position.
TRANSPORTATION		Slowly and carefully. Transport in sitting position. Administer oxygen. If in cardiac arrest maintain cardiopulmonary resuscitation.

Table 1. Symptoms and Treatment of Heart Attack.

is not receiving stimuli from the brain, the heart falters and stops and the patient is in a state of cardiac arrest.

At the moment heart action stops, respiration and the other usual signs of life are absent, a patient is said to be clinically dead; however, even though respiration and heart action have stopped, the cells of the body will live for a short time until their supply of residual oxygen is used up. The length of time that the cells will live depends a great deal on their need for oxygen. Some cells, such as those found in cartilages of the joints, may live for hours while other cells die very quickly. For example, the cells of the brain die from four to six minutes after being deprived of oxygen and blood. At the end of this period, irreversible brain damage has occurred and the patient has passed into the state of biological death, from which there is no return.

Even though the period between clinical death and biological death is extremely short, a patient may be successfully resuscitated if oxygenated blood can be circulated throughout the body by some artificial means until the heart can operate on its own once again, though some brain damage may occur in the interim.

Remember, absence of oxygen in the brain for any amount of time may result in a certain amount of brain damage, but after four to six minutes, irreversible cell damage and death are almost inevitable. As the time without oxygen increases, the patient's chances of recovery decrease rapidly. Thus, successful treatment of cardiac arrest is directly related to the speed and efficiency with which such treatment is applied.

HEART DISORDERS

As you already know, the heart is a very efficient pump and is vital to life. Normally, it pumps the blood to all parts of the body with accuracy and precision even when the body slows down (as in sleep) or in strenuous exercise. Occasionally, however, the heart fails to perform its function properly or perhaps altogether. This has many common names, most of which are wrong. Each heart condition requires a specific course of emergency treatment by the rescueman.

Cardiac Arrest

Cardiac arrest occurs when the heart fails to supply the body tissue with blood. There are many types of cardiac arrest but the most common are:

1. Ventricular standstill - the heart muscle is at a standstill.

2. Ventricular fibrillation - all the heart muscles are working independently giving the heart a quivering motion. Normally, all muscles work together to supply the body with blood.

3. Cardiovascular collapse - the valves and vessels of the heart deteriorate to the point that they, for all practical purposes, collapse.

> Note: Cardiac arrest is not a heart disorder but rather the result of one. The rescueman will not be able to determine which type of cardiac arrest is present. In any case, the rescueman must maintain the circulation artificially.

Heart Attack (See Table 1)

"Heart attack" is an acute condition known as coronary occlusion, or coronary thrombosis, a sudden blocking of the coronary arteries that normally supply the heart muscles with blood. Heart attack is sudden and is actually the result of a slowly developing hardening of the coronary arteries, called arteriosclerosis. This condition is responsible for most heart attacks and for the accompanying chest pains known as angina pectoris.

With arteriosclerosis, the inside of the arteries become narrowed and roughened by fatty deposits, which harden into patches along the inside of the arteries. Scar-like tissues form around these patches so that the

SYMPTOMS AND TREATMENT OF ANGINA PECTORIS

	Symptom	Treatment
PAIN	In chest or arm.	Administer doctor's medication if under the care of a physician. If not, treatment is the same as heart attack.

SYMPTOMS AND TREATMENT OF CHRONIC HEART FAILURE

	Symptom	Treatment
PAIN	Not a reliable symptom.	
RESPIRATION	Cyanotic, shortness of breath, noisy respiration.	Administer 100% oxygen. If patient does not improve, a bag mask attached to the oxygen supply should be used.
UNCONSCIOUSNESS	Usually conscious but unable to move around.	Maintain open airway.
SWELLING	Of hands and feet from previous attacks.	Not a problem for person administering first aid.
APPREHENSION AND FEAR	Present and also profuse sweating.	Talk to him and do not allow him to chill.
SHOCK	Usually present.	Make victim comfortable, reassure him, and keep him warm. Note: Keep him in sitting position.

Table 2.

channels are narrowed and there is less space through which the blood can flow.

After the artery has been narrowed, a blood clot may form and block the flow of blood. If the blockage is complete, the part of the heart muscle that is supplied by that artery dies, due to lack of oxygen and nutriments supplied by the blood. The effect on the patient is immediate. He complains of piercing pain under the sternum (breastbone) and a sudden shortness of breath and he usually sweats profusely.

The severity of the heart attack depends on the amount of heart muscle damage. A completely blocked coronary artery that supplies a large area of the heart muscle may cause an attack resulting in instantaneous cardiac arrest. On the other hand, a small clot that blocks the flow for only a short time and then disappears may produce only temporary discomfort.

The symptoms of heart attack vary according to the severity of the attack and the amount of damage that results. A firefighter is expected to recognize every symptom of heart attack and he should also realize that each symptom calls for certain techniques of care.

Angina Pectoris (See Table 2)

Another heart condition, which is often mistaken for indigestion, is called angina pectoris or more commonly, angina. In angina, the blood supply to the heart muscle is decreased because of a narrowing of the coronary artery. The pain is similar to that of a heart attack, although not so severe an attack of angina is characterized by pain in the chest or arm, while a heart attack first produces a severe pain beneath the sternum and then pain that radiates into the shoulder, neck, arm, and hand. Attacks of angina are brought on by emotional stress, strenuous physical exertion, or agitation.

Angina attacks usually last only a few minutes, and they are generally relieved by rest. Nitroglycerine is commonly prescribed for angina because it causes the blood vessels to dilate. The patient places a tablet under his tongue where it dissolves and quickly enters the circulatory system. If the patient with a suspected angina attack is not taking medication or if the medication does not effectively relieve the pain, he should be treated as if he were having a heart attack.

Chronic Heart Failure

Chronic heart failure is primarily caused by advanced age, certain diseases which weaken the heart muscle, or a prior heart attack. Chronic heart failure is a condition in which the heart is no longer able to carry its normal workload.

The heart is actually two pumps in one. Because the left ventricle is required to do much more work than the right ventricle, it has a greater tendency to fail.

When the left ventricle fails to operate properly, an injurious chain of events is initiated. Because the chamber does not empty with each contraction of the heart muscle, it cannot handle the amount of blood returning from the lungs. The blood accumulates in the lungs and fluids from the blood tend to seep into the alveoli. The congestion in the lungs reduces the exchange of oxygen for waste materials, causing anoxia, or oxygen starvation.

Because the lungs are full of fluid, they cannot receive the blood that is being pumped to them by the right ventricle and due to the reduced circulation, fluids may back up into all parts of the body. This chain of events produces the symptoms of chronic heart failure and a need for specific course of action by the person administering first aid is evident.

The fireman should determine rapidly and easily whether or not cardiac arrest has occurred for three signs, all of which must be present if heart action has stopped.

1. NO RESPIRATION. Check for breathing action as described for pulmonary resuscitation.

2. LOOK for movement of the chest.

3. LISTEN AND FEEL for air exchange at the mouth and nose.

If there are signs of respiration, there is no possibility of cardiac arrest. At any rate, the patient will need some sort of artificial ventilation as the minimum treatment.

Signs of Cardiac Arrest

Check for heart action by feeling for either the carotid pulse in the neck, or the femoral pulse in the groin. The carotid and femoral arteries are quite large and normally their pulses are easily felt if there is sufficient heart action to circulate blood. If a pulse can be felt, the patient is not in cardiac arrest and may need only to have his breathing restored or supported. However, if a pulse cannot be found, cardiac arrest is indicated. To be sure, check further.

Dilated pupils of the eyes - check the pupils of the patient's eyes to see if they are dilated. Constricted (narrow) pupils indicate that there is blood circulating, while dilated pupils (those which are quite large) indicate that blood circulation has stopped. Within 45 seconds to one minute after cessation of circulation to the brain, the pupils begin to dilate; within another minute, the dilation will be complete. Thus, if the pupils appear dilated, no oxygenated blood is being circulated to the brain. This sign, coupled with the first two, calls for immediate reestablishment of breathing and heart action by artificial means known as cardiopulmonary resuscitation.

REMEMBER: Three signs must be present if the patient is in cardiac arrest.

1. No respiration.

2. No pulse.

3. Dilated pupils after two minutes.

Cardiopulmonary Resuscitation

Cardiopulmonary resuscitation is another name for heart-lung resuscitation, or the combination of efforts to restore breathing and circulation artificially. While there are many mechanical devices that can be used to perform both phases of cardiopulmonary resuscitation, and equally as many devices that can be used for the ventilation phase, the manual method is suggested here. The manual method is very effective; it requires no sophisticated equipment that is subject to failure and no preparation time.

Physical Structures

In order to perform the techniques of cardiopulmonary resuscitation properly, the rescueman must be familiar with the relationship of the heart to the other structures of the chest, and to the chest itself. This awareness not only makes it easier to learn the procedure, but also serves to stress the dangers of performing cardiopulmonary resuscitation incorrectly.

The heart is located between the lungs, with about two thirds of its bulk situated to the left of the midline of the body. Located in the middle of the chest is the sternum (breastbone), which is a flat, bony structure that joins the ribs in front of the chest. At the lower end of the sternum is a bony prominence that curves inward which is called the xiphoid process. It plays an important part in the positioning of the operator's hands when performing cardiopulmonary resuscitation. The upper end of the sternum is joined to the clavicle (collarbone). The ribs provide a protective cage for the lungs, which lie directly below them and to some extent for the liver, which lies below part of the sternum.

Mechanics of Artificial Circulation

Artificial circulation is produced when the chest is compressed from 1-1/2 to 2 inches, which, in turn squeezes the heart between the sternum and the spine (see figures 14a and 14b). When the heart is squeezed in this fashion,

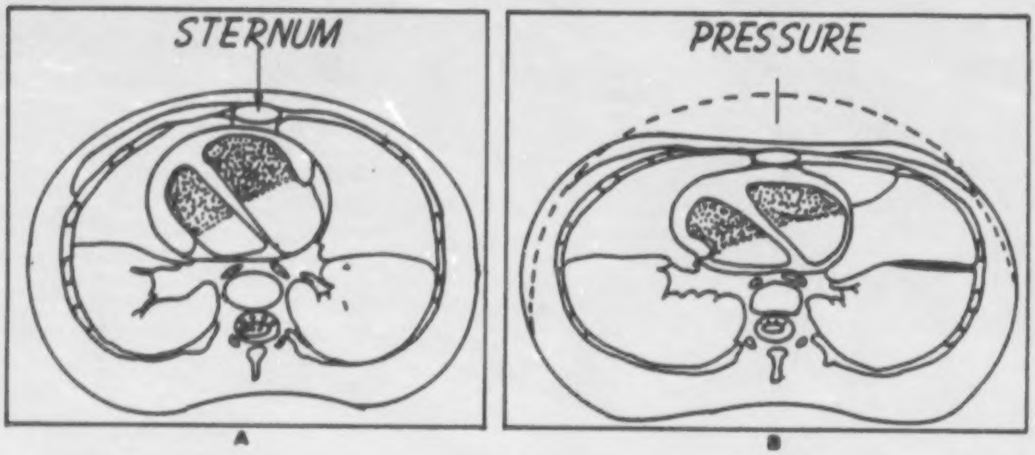

Figure 14. Mechanics of Cardiac Compression (Artificial Circulation).

blood is forced into the pulmonary circuit to the lungs, where it is oxygenated, and into the systemic circuit, through which it travels to all parts of the body. When pressure on the sternum is relaxed, the elastic chest wall causes the sternum to spring outward to its original position. The release of pressure on the heart results in a sucking action that draws blood into the heart from the veins and the lungs. The blood is kept in constant motion as long as the heart is squeezed and released by external chest compressions. The result of properly performed cardiopulmonary resuscitation is approximately 35% of that which is produced by a normally operating heart.

Techniques of Cardiopulmonary Resuscitation

REMEMBER: Cardiopulmonary resuscitation is a combination of efforts to maintain breathing and circulation artificially until the normal heart-lung relationship is restored.

It should also be remembered that when a patient is in cardiac arrest, artificial circulation is ineffective without artificial ventilation, since otherwise there is no means of oxygenating the blood that is being circulated. By the same token, when a victim is in cardiac arrest, artificial ventilation is ineffective without artificial circulation, since ventilation provides no means of circulating the blood. The sequence of operations required in cardiopulmonary resuscitation is best remembered by the ABC technique.

A STANDS FOR AIRWAY. Assure that the patient has a clear airway, that the head is in the proper position, and that the throat is free from foreign objects.

B STANDS FOR BREATHE. Inflate the patient's lungs immediately with four quick, double-sized breaths, using mouth-to-mouth technique, or mouth-to-nose if necessary. This will provide a high concentration of oxygen in the lungs that is immediately available for circulation to the brain.

C STANDS FOR CIRCULATE. Properly situate the patient, locate the pressure point, place your hands properly, apply pressure, and interpose ventilations.

The patient in a cardiac arrest must be placed on a hard and unyielding surface, such as a floor or the ground. If he is on a bed or an ambulance cot, a spine board backboard, serving tray,

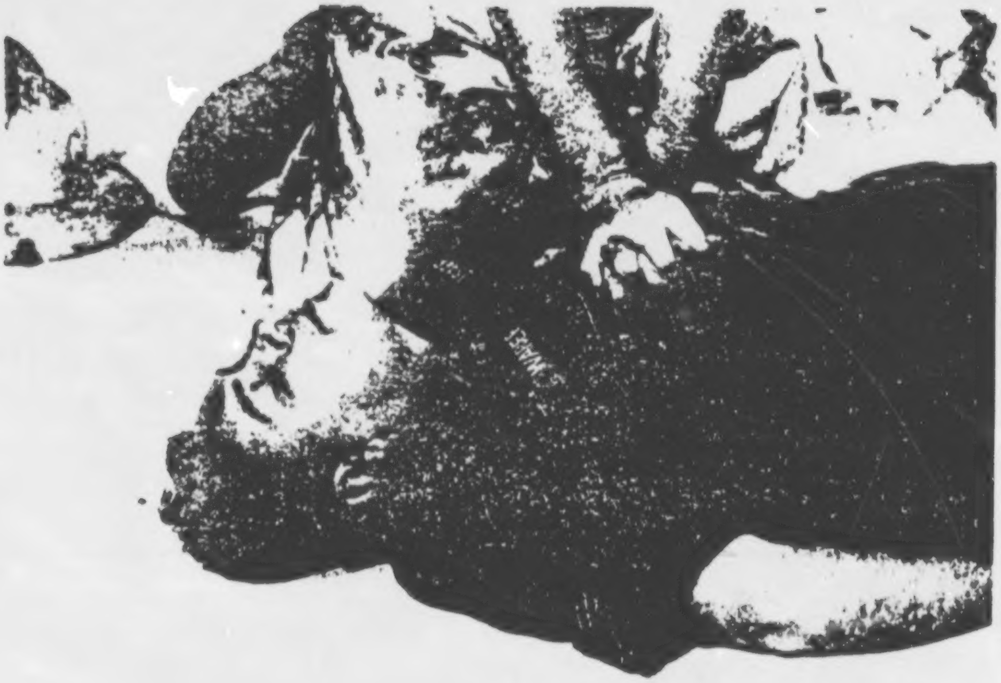

Figure 15. Placement of Hands for Artificial Circulation.

or similar object should be slipped underneath his back. Attempting to compress a patient's chest while he is on a mattress or other soft surface results only in pushing his entire body downward. It is important to determine the exact point on the sternum where pressure must be applied when compressing the chest. The sternum is hard and the abdomen is soft, so the point where they come together can be found easily. It is equally as easy to find the upper end of the sternum by locating the notch where the sternum attaches to the collarbone. The pressure point is in the center of the lower half of the sternum. Pressure must be applied to this point and nowhere else if the technique is to be effective and damage to other structures avoided. This is extremely important.

The heel of one hand is placed over the pressure point, and the heel of the other hand is placed over the back of the first (see figure 15). The fingers of each hand should be held outward and as high as possible, so that contact with the ribs is avoided. The rescueman should position himself over the patient, close enough so that he can apply pressure downward vertically, thus, utilizing the entire weight of his upper body.

REMEMBER: Any deviation from this procedure for placing the hand may result in damage to the ribs and underlying organs.

In order to assure that adequate blood circulation is taking place, the heart must be compressed with firm, heavy pressure. While the amount of pressure depends on the age and size of the patient, the sternum is generally compressed about 1-1/2 to 2 inches. The sternum is held down for about a half second, and then is quickly released. Compressions are made at the rate of about 60 per minute if two rescuemen are operating; however, if one rescueman is acting alone, the rate should be 80 per minute to allow for the time spent ventilating the patient. The compressions must be continued until the patient shows signs of recovery, or until qualified medical personnel take over. Cardiopulmonary resuscitation efforts SHOULD NOT BE INTERRUPTED FOR ANY REASON and should be continued even while the patient is being loaded onto the ambulance or unloaded at the hospital.

The rescueman must maintain the proper rate at any cost. Any rate lower than the 60/80 described above will result in disaster. Once the rate has been started, it must not be interrupted for any reason for more than five seconds.

REMEMBER: Chest compressions without ventilation are of little value to the patient, since the only air exchange is that which might result from the chest movements caused by their compression efforts. This limited exchange is not sufficient to oxygenate the blood.

To provide the pulmonary phase of cardiopulmonary resuscitation, some means of artificial ventilation must be supplied by the mouth-to-mouth or mouth-to-nose techniques, by a bag mask resuscitator, or by mouth-to-adjunct method. Pressure-cycled resuscitators should not be used, since the cycling of the machine can be interrupted by the chest compressions, resulting in insufficient supply of air to the patient's lungs. On the other hand, ventilation with a volume-cycled resuscitator is highly desirable if such equipment is available. This technique provides the patient with a much greater concentration of oxygen in a short time, which greatly speeds his recovery.

When it is necessary to perform cardiopulmonary resuscitation (CPR) with one rescuer, the following steps should be taken:

1. Place the patient on his back on a hard surface, preferably the floor or ground.

2. Upon determining that the patient is in cardiac arrest (by checking the three signs), immediately establish the airway and ventilate the patient with four double breaths.

3. Shift to the patient's side and compress his chest 15 times at a rate of 80 times per minute, making sure that your hands are always in the proper position. See figure 15.

4. After the 15th compression, quickly pivot back to the patient's head and inflate his lungs two times without a pause between ventilation.

5. Return to the chest and compress the chest 15 times.

6. Repeat the cycle of 15 chest compressions to two ventilations without interruption until the patient shows signs of recovery or until you are relieved by competent medical personnel.

CPR With Two Rescuemen

The most effective cardiopulmonary resuscitation can be accomplished by two rescuemen working together. The two-man method is not only more effective, but far less tiring than the one-man method. The following steps should be taken:

1. Place the patient on a hard surface.

2. Determine his condition through the three signs.

3. One rescueman positions himself at the patient's head where he establishes an open airway and quickly ventilates the patient with four double-sized breaths.

4. The other rescueman positions himself at the patient's side opposite the first rescueman and starts manual compressions at the rate of one every second as soon as the patient is ventilated. Rescueman at the head then interposes a quick double-size breath after every five (5) chest compressions. Repeat one to five cycle without interruption until relieved. If it is necessary to change position because one or both of the rescuemen become tired, it is best that they be on opposite sides while performing two-man cardiopulmonary resuscitation, see figure 16.

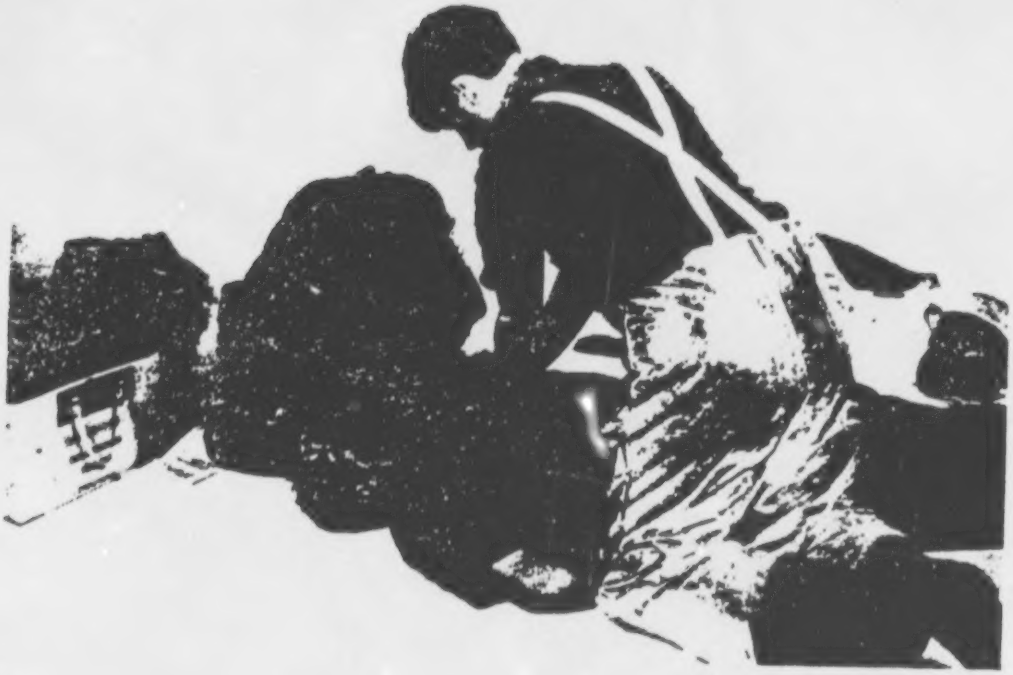

Figure 16. Position of Rescuemen in Cardiopulmonary Resuscitation.

Technique For Children

The procedures for performing chest compression on children are different from those used for adults, in that much less pressure is required. However, a faster compression rate should be used to compensate for the child's faster heartbeat.

1. For children weighing less than 80 pounds, use the heel of one hand only.

2. For infants, use only the tips of the fingers. Do not press too hard, for the heart muscle of an infant is easily bruised.

3. An easy way to perform cardiopulmonary resuscitation on an infant is to cradle him on your arm, with the head supported in your hand. In this position, it is easy to compress the chest and to interpose the breaths.

REMEMBER: Much less effort should be used when ventilating a child. When ventilating an infant only PUFFS from the checks should be used.

Effectiveness of CPR Efforts

If the patient can be successfully resuscitated - that is, if biological death has not occurred, the effectiveness of cardiopulmonary resuscitation efforts can be measured by certain changes in the patient's condition. If the efforts are successful, the following changes will occur:

1. The pupils of the eyes MUST constrict.

2. The patient's color MUST improve.

3. A pulse MUST be felt at the carotid artery with each cardiac compression.

A change in pupil size and a freshening in the patient's skin color are both good indications that the oxygenated blood is being circulated. A carotid pulse felt at the time of each chest compression is an indication that the heart is being squeezed sufficiently to circulate the blood.

In addition to changes that MUST occur if cardiopulmonary resuscitation efforts are effective, the following changes MAY occur:

1. Spontaneous respiration MAY begin.

2. The arms and legs of the patient MAY move.

The return of spontaneous respiration is an indication that the heart-lung-brain relationship has been restored and is returning to a normal state and that normal heart action will result. At this point, the patient may need only to be watched carefully, or at the most, to have his breathing supported.

The rescueman should not be discouraged if the patient does not start spontaneous circulation and breathing even after proper CPR methods have been used. In most cases, the patient will not fully recover until definite (in the hospital with drugs and complicated treatments by physicians) care has been accomplished. You are the vital link between the time circulation stops and he reaches the hospital.

Complications of Cardiopulmonary Resuscitation

Damage to the thoracic cage or chest cavity and the underlying organs can be caused by improper placement of the rescueman's hands during chest compression. When the hands are placed too far to the right, the ribs may be fractured, causing lacerations to the lungs and possibly to the heart muscle itself. When the hands are placed too far to the left, ribs may be fractured and the underlying lung tissue lacerated. When the hands are placed too low, there is the possibility that the bony prominence called the xiphoid process may be depressed too far, thus lacerating the liver. When the hands are placed too high, the collarbone may be broken where it joins the sternum.

Even with the hands placed in the proper position on the sternum, there is a possibility that the force required to compress the chest adequately will be sufficient to break ribs. However, it would be far better for the patient to suffer the temporary discomfort of a few broken ribs than die, simply because the rescueman declined to perform cardiopulmonary resuscitation through fear of inflicting injury. Some of the most common errors in performing CPR are: failure to maintain proper head extension, improper compression pressure, and incorrect rate of compressions to allow for breathing phase.

SUMMARY

In this study guide, we have covered the correct procedures when performing cardiopulmonary resuscitation and the steps to be followed. It is important for a rescueman to know these procedures to properly perform emergency treatment of cardiopulmonary arrest.

QUESTIONS

Answer questions on a separate sheet of paper. The answers will be checked and evaluated by your instructor. Do not write in this book.

1. Without oxygen, the brain will begin to die in __________ to __________ minutes.

2. Cardiac arrest is

a. when the patient is not breathing.

b. when the heart stops pumping blood.

c. a heart attack.

d. a cause of heart attack.

3. When performing CPR, you are actually squeezing the heart between the __________ and the __________.

4. The rate for CPR is __________ to __________ with one rescueman and __________ to __________ with two rescuemen but you always begin CPR with __________ double-sized breaths.

5. When performing the compression phase of CPR, the chest is compressed ________ to ________ inches.

6. Three of the most common errors committed when performing the cardiac compression phase of CPR is

a. failure to maintain the __________ __________.

b. keeping uneven __________ __________.

c. __________ to allow for the pulmonary phase.

7. Once started, CPR must not be stopped, for any reason, for more than __________ seconds.

8. Anything less than the __________ __________ for CPR is useless.

9. __________ __________, __________ __________, and __________ __________ are all examples of cardiac arrest.

10. Match the letter with the correct number.

_____a.	Clinical death.	1.	As soon as heart action stops.
_____b.	Biological death.	2.	Four to six minutes after the heart stops.

11. The body functions are carried on by a close relationship among the __________, __________, __________, and __________.

12. Which one of the following statements is correct?

a. A victim of cardiac arrest may be breathing.

b. A victim of cardiac arrest is never breathing.

c. A heart attack is usually very gradual.

d. A heart attack always results in cardiac arrest.

REFERENCES

1. IFSTA #109, Fire Service First Aid Practices.

2. American Heart Association Pamphlet.

Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-WB-212
18 July 1975

RESPIRATORY EMERGENCIES AND ARTIFICIAL RESPIRATION

OBJECTIVES

After completing the study guide and classroom instruction, and using the workbook checklist, you will be able to:

1. Demonstrate inhalation procedures using a manikin and respiration device.

2. Demonstrate aspiration procedures using a manikin and aspiration device.

EQUIPMENT

	Basis of Issue
Manikin	1/5 students
Air Bag Resuscitator	1/5 students
Mechanical Aspirator	1/5 students

PROCEDURES

Procedures for using the respiration device:

1. Hold the face piece over the manikin face.

2. Clamp securely in place with one hand.

3. Press your thumb over the rim of the mask.

4. Use your third, fourth, and fifth fingers to pull the chin upward and backward.

5. Take a firm grip but never poke your fingers into manikin's neck.

6. Do not push the mask down on the manikin's chin as this may flex the neck and obstruct the air passage.

7. While holding the mask with one hand, squeeze the bag with the other hand.

8. Squeeze bag about once every five seconds.

9. Squeeze bag until chest rises.

OPR: TWS
DISTRIBUTION: X
TWS - 2,000; TTVGC - 2

Designed for ATC Course Use. Do Not Use on the Job.

10 Release bag to allow for exhalation.

11. If leakage occurs, hold mask more tightly and squeeze the bag more forcefully.

12. Airway must be open at all times.

Procedures for using an aspiration device:

1. Place manikin on its back.

2. Extend head back to open airway.

3. Place mechanical aspirator near the manikin's head.

4. Place your thumb on the manikin's lower teeth and your fingers on the upper teeth near the corner of the mouth.

5. Using a flipping motion of your fingers, pry the jaws apart.

6. Measure the distance from the corner of the manikin's mouth to the ear lobe. This is the maximum distance that the catheter is to be inserted.

7. While holding the patient's jaws apart, sweep the suction tip throughout his mouth.

8. As the suction tip is being swept through the manikin's mouth, you can use either the hand or foot to pump the mechanical aspirator.

QUESTIONS

Answer the following questions on a separate sheet of paper. DO NOT write in this book.

1. How many times per minute do you squeeze the bag mask?

2. What do you do with the aspirated fluid from the victim?

3. How far into the mouth do you place the catheter?

4. If the mask leaks air, what do you do to correct it?

5. Do you remove the mask for the exhalation phase?

BLOCK III AND IV ORIENTATION

INTRODUCTION

TIME: 5 min

Attention: Congratulations, you have successfully progressed to the second step of the ladder toward your three level in the fire protection career field.

Review: You have just studied about such things as protective clothing, breathing apparatus and the nature of fire, to name a few.

Overview: During this half hour we will introduce ourselves, discuss school policy, student responsibilities, subjects in Block III and IV, fire department work in general, safety and energy conservation.

Motivation: Your responsibilities in this new block have changed. You will be meeting a new challenge each day. Personal satisfaction will come from successful completion.

Transition: Today's lesson will begin with the introduction of the instructor.

BODY

TIME: 20 min

Presentation:

TIME: 15 min

1. Block Content

    a. Instructor Introduction

    Stress energy and materials conservation

        (1) Air Force service time

        (2) Instructor time

    b. Student Introduction

        (1) Name and from what state

        (2) Previous firefighting experience

        (3) Like or dislike of firefighting career field

    c. Instructional periods and conduct

    Explain yellow line in break area

        (1) Class period and break time

        (2) Class leader and his authority

   - (3) Block III, one week duration
   - (4) Block IV, two weeks in duration
   - (5) Written test at end of each block

d. Alarm room procedures and operation

   - (1) The center of fire department activity
   - (2) Manned 24 hours a day

e. Ladder operations

   - (1) Various types of ladders are used
   - (2) Ladders are used to reach upper stories or roof of buildings

f. Appreciation of Hydraulics

   - (1) Science dealing with the properties of liquids at rest or in motion
   - (2) Used in firefighting to determine pressures dealing with water in hose lines and nozzles

g. Pump Operations

   - (1) Operating fire pumps on vehicles
   - (2) Necessary to insure adequate pressure is available to get water to the fire

h. Hose Operations

   - (1) The firefighters use hose of various sizes
   - (2) A nozzle is attached to the hose
   - (3) The use of hose and nozzles is the most common method to extinguish structural fires

i. **Vehicle Relay Operations**

   (1) More than one vehicle between the source of water and the fire

   (2) Used when long distance between fires and water source

   (3) Necessary to insure adequate water pressure to move water to the fire

j. Fire Department

   (1) May be assigned to crash or structural

   (2) Normally two shifts, 24 hours each

   (3) Assigned to specific vehicle

   (4) Each man is an important member of his crew

2. Safety

   a. Students will not open or close hangar doors

   b. Watch for moving equipment

   c. Backing vehicles - two men required

   d. Do not lean in chairs

   e. Report injuries no matter how small

   f. Jewelry

   g. Horse play not tolerated at all

   h. Drafting pit area slippery when wet

   i. Protective headgear

   j. Ice

   k. Running at no time

   l. Work as a team, failure to do so could result in injury

3. Energy Conservation

    a. Conserve all training material

    b. Keep use of gasoline operated power trucks to a minimum

    c. Do not abuse protective clothing, other students must also use

    d. Operate vehicles at minimum rpm

    e. Do not overflow trucks with water

    f. Do not waste cleaning materials

    g. Carefully inspect tires and tire pressure

    h. Report leaking trucks, watch for expanding gasoline in trucks, better inspection and operator maintenance and proper operating of Air Force equipment will prevent damage resulting in costly repairs

Application: TIME: N/A

Evaluation: TIME: 5 min

Interspersed throughout the presentation.

CONCLUSION TIME: 5 min

Summary: You have been given an orientation of blocks III and IV pertaining to your responsibilities, safety, care of equipment and block length. Keep these things uppermost in your mind.

Remotivation: You are an important part of this school. Learn and obey the guidelines set forth and the day you graduate you will know the feeling of accomplishment.

Assignment: N/A. Continue with Operations, Maintenance and Mounted Equipment on the P-10 Rescue Vehicle.

Closure: Remember, it is up to you to take care of equipment and the school area, and to observe all safety precautions. You must keep in mind your obligation to your instructor, class leader, and your crew.

OPERATIONS, MAINTENANCE AND MOUNTED EQUIPMENT ON THE P-10 RESCUE VEHICLE

INTRODUCTION

TIME: 5 min

Attention: The alarm sounds, and you respond to your assigned vehicle, as you round the corner the crew chief tells you to drive the P-10, as the regular driver is in the hospital.

Review: We have just had a discussion on block length, student responsibility and safety.

Overview: During this lesson we will discuss safety, inspection, operator maintenance, location of tools and equipment, and the operation of all accessory equipment. You will be required to perform all operations.

Motivation: Even as a newly assigned member of a structural vehicle, you could be called upon to act as a driver of the P-10 and it is a must that you be able to operate this vehicle in a proficient manner.

Transition: Today's lesson will begin with vehicle inspection, and operator maintenance.

BODY

TIME: 5 hrs 20 min

Presentation:

TIME: 1 hr 10 min

1. Given the appropriate inspection checklist and technical data, inspect and perform operator maintenance on the P-10 rescue vehicle and mounted equipment. All appropriate items on the inspection checklist must be inspected. Operator maintenance must be accomplished according to the technical order.

   a. Identify items to be inspected.

      (1) Engine

         (a) Check oil level when cold

         (b) Use 30 wt. oil

      (2) Transmission

      (3) Gearbox

Use Applicable T.O. 36A12-12-13-1

Use WB 302

Use: P-10 and Mounted Equipment

Stress energy and materials conservation

(4) Radiator

(5) Fuel

  (a) Gauge

  (b) Tank

(6) Hydraulic fluid levels

  (a) Power steering

  (b) Brakes

(7) Check for leaks

  (a) Air

  (b) Fuel

  (c) Coolant

  (d) Hydraulic

(8) Check seat belts

(9) Wheels

  (a) Tires

  (b) Lugs

  (c) Tire pressure

(10) Battery

  (a) Damage

  (b) Cleanliness

  (c) Mountings

  (d) Liquid levels

(11) Brakes

  (a) Foot pedal

  (b) Hand brake

(12) Clutch

- (13) Electric System
    - (a) All lights
    - (b) Sirens
    - (c) Radio
    - (d) Horn

INTERIM SUMMARY

- b. Identify tools to be inspected
    - (1) K-12 power saw — Stress Safety
        - (a) Engine
        - (b) Ignition system
        - (c) Fuel system
        - (d) Clutch
        - (e) Drive belts
    - (2) Portable generator
        - (a) Engine
        - (b) Generator
        - (c) Receptacles for damage
    - (3) Portable blowers
        - (a) Starter cord
        - (b) Fuel system
    - (4) Breathing apparatus
        - (a) Cylinders
        - (b) Case
        - (c) Condition
    - (5) Portable light equipment
        - (a) Lights
        - (b) Extensions/wye connections

- (c) Hand lanterns
- (6) Fire extinguishers
- (7) Hand tools
  - (a) Axe
  - (b) Insulated cutters
  - (c) Initiator cutter
  - (d) V-blade knife
  - (e) Shovel
  - (f) Pike pole
  - (g) Tool kit
- (8) Folding litter
- (9) Plugs
- (10) Ropes
- (11) Safety goggles
- (12) Winch
  - (a) Grapnel/cable
  - (b) Controls

INTERIM SUMMARY

c. Identify tools to be serviced

Properly operate Air Force equipment. Prevent damage resulting in costly repair.

- (1) K-12 power saw
- (2) Portable blower
- (3) Breathing Apparatus
- (4) Portable lights
- (5) Fire extinguishers
- (6) Report and note any discrepancies
- (7) Reservice vehicle, and mounted equipment after each operation

2. Given a P-10 rescue vehicle and mounted equipment, demonstrate the use of, and reinstall tools and operate equipment in accordance with appropriate technical data while observing all applicable safety procedures.

Use P-10 Rescue Vehicle

a. Crew

Stress safety while working around P-10 rescue vehicle

(1) three men

(2) Driver, two additional rescuemen

b. Extinguishing agents

(1) Six (6) dry chemical fire extinguishers

(2) Each is hand operated and cartridge operated type

(3) Two(2) for A, B and C fires (Red)

(4) Three (3) for B and C fires (Blue)

(5) One (1) for D fires (Yellow)

c. Mounted tools and equipment

(1) K-12 high speed portable circular saw with gasoline engine

(2) Complete rescue saw kit containing

(a) K-12 saw

(b) Heavy duty steel carrying case

(c) Spare parts and field service kit

(d) One (1) gallon safety gasoline can

(e) One (1) quart of 2 cycle engine oil

(f) One quart of gasoline stabilizer

(g) One 12" concrete cutting blade.

(h) One 12" steel cutting blade

(i) One 12" carbide tip blade

(j) One pair of safety goggles

(k) One spare drive belt

(l) One spare air filter

d. Operate the K-12 saw

Safety goggles will be worn whenever you are operating a K-12 saw

(1) Remove saw from carrying case

(2) Place saw on suitable level location

(3) Close choke by pushing down choke arm located on the right and slightly below the rear handle

(4) Lock throttle open by engaging trigger half way and pushing in the throttle lock pin on the control switch

(5) Lay saw on a firm surface and place one hand on top of the carring handle

(6) Pull starting cord until engine starts

(7) To stop engine, press button and hold until engine stops

(8) Return to carrying case

e. Engine - Driven Blowers

Operate air vent and fuel shut off prior to starting

(1) Two portable blowers are used to clear fumes from enclosed areas. Cooling aircraft brakes and removing smoke are other practical uses of the blowers.

(2) Each blower consists of a large fan driven by a two cycle gasoline engine.

f. Portable lighting equipment

  (1) Two quartz-iodide portable flood lamps

  (2) Two 50 ft. extension cords

  (3) "Y" connector to connect flood lights to portable generator

INTERIM SUMMARY

g. Portable generator

Do not touch exhaust unit or cylinder housing or burns may result

  (1) Portable gasoline engine driven 1000 watt generator

    (a) One cylinder, 4 cycle engine

    (b) Manual pull on cord type starting is employed

    (c) Operate the portable generator

      1. Remove generator from utility body on truck

      2. Place start lever in start position

Never operate in a closed room or building

      3. Start engine

      4. Allow engine to warm

      5. Plug flood lights into receptacles

      6. Attend engine so it does not stall when load is connected

      7. When finished, unplug load and stop engine

      8. Return generator to truck

h. Electric Hand Lanterns

  (1) Two battern powered electric lanterns

  (2) 7½ volt dry cell battern

(3) Lanterns have two levels of brightness

i. Pry Axes

(1) Three multi-purpose pry axes designed for use at fires, wrecks, lockouts.

j. Firemans Axe

k. Insulated Cutter

(1) Capable of cutting 3/8 inch material and has a rating of 20,000 volts

l. Harness Cutters

(1) Two converging steel blades for cutting seat belts and harness

m. Tube Cutter (Dis-Arming Tool)

(1) Used to dis-arm ejection seats

n. Pike Pole

(1) Six foot fiberglass handle

o. Folding Litter

(1) Collapsible and can be folded into a four foot length

p. Rope

(1) Two manila ropes

(2) 75' x 3/4 inch

q. Safety goggles

(1) Three pair, industrial goggles

Safety goggles will be worn whenever you are operating a K-12 saw

r. Safety Pins

(1) 12 safety pins

(2) Six oil resistant, hard rubber

(3) Six hard wood

t. Tool kit

(1) Canvas carrying bag which contains the following

(a) Hammer, hand, ball peen, 1½ lb.

(b) 14 inch pipe wrench

(c) Pinch metal cutting shears

(d) 8 inch linemans pliers

(f) 8 inch screwdriver

(g) 6 inch screwdriver

(h) hitch screwdriver

(i) Socket set

(j) 3 cold chisels

u. Winch

(1) 8,000 pound mechanical drum type winch

(2) Cable, 200 ft x 3/8 inch'

(3) Winch operation is controlled by a transfer case shift control, power take off and a transmission shift control located in the cab

Use: Helmet
Gloves

(4) Operate the winch and grapnel

Insure gloves are worn while operating winch and cable

(a) Insure that parking brake is set

(b) Place transmission and transfer case in neutral

(c) Disengage winch clutch on winch by moving lever up

(d) Pull out cable as required

Do not let cable slide through hands, walk cable in

(e) Engage winch clutch on winch by moving lever down

(f) Pull out power take-off knob on floor, inside cab

(g) Place transmission in forward gear and release clutch to wind

(h) Place transmission in reverse gear and release clutch to unwind

v. Hand signals for winch operation

(1) Closed fist: Stop cable

(2) Closed fist, thumb pointing up: Reel cable in

(3) Closed fist, thumb pointing down: Reel cable out

3. Given necessary equipment, perform preventive maintenance on the P-10 rescue vehicle and mounted equipment IAW AFTO Form 433. Maintain station facilities as required.

a. Preventive maintenance

(1) Wash vehicle

(2) Wax vehicle (if needed)

(3) Clean tools and equipment

Application: TIME: 4 hrs

Interspersed throughout the presentation.

2 INSTRUCTORS ARE REQUIRED

Evaluation: TIME: 10 min

Interspersed throughout the presentation.

CONCLUSION TIME: 5 min

Summary: We have covered the P-10 operations and maintenance, located tools and equipment, and used safety precautions at all times during each phase.

Remotivation: The need for proficient driver/operators of rescue vehicles is great. You should contimually update your knowledge of this and be ready in case of any eventuality.

Assignment: Read and study the following SG units and answer the questions at the end of each unit.

1. SG-303, Pre-Fire Plans

2. SG-304, Miscellaneous Rescue

Closure: Although not actually involved in the extinguishment of a fire, the driver operator of the P-10 rescue vehicle is essential to the members of his crew and should be proud of a job well done.

PRE-FIRE PLANS

INTRODUCTION

TIME: 5 min

Attention: The alarm bell goes off! There is a fire in building 432, where is building 432? How do you get there? Is there a hydrant close to the building? All of these questions have already been answered for you by your pre-fire plans.

Review: We have just studied the P-10 rescue vehicle and know the important part it plays at any fire scene.

Overview: Today we will have a discussion on the preparation of pre-fire plans to include, life hazard, types of construction, and interior and exterior exposures.

Motivation: Pre-fire planning is an important part of the fire department as it enables you to have a plan of action to take in the event of a fire in any building on your base, or aircraft incident or accident.

Transition: Today's lesson begins with the basic preparation of pre-fire plans.

BODY

TIME: 1 hr 50 min

Presentation:

TIME: 1 hr 40 min

1. Without reference, identify basic facts concerning preparation of pre-fire plans. Eighty percent of the basic facts must be identified correctly.

Show film TF 6058, "Structural Fire Suppression"

a. Pre-fire Plans

Stress energy and materials conservation

(1) Indoctrinate supervisors and subordinate fire suppression personnel in all known factors, (location, physical layout, water supply, occupancy, etc.) in facilities and aerospace vehicles and how to take advantage of these factors.

(2) A pre-fire planning program will be implemented at all Air Force installations to insure effective fire response procedures.

(3) The problem is founded on five basic divisions of firefighting tactics called size up.

(a) Life hazard (rescue of personnel)

(b) Protection of exposures (interior and exterior)

(c) Confinement

(d) Extinguishment

(e) Overhaul (prevent rekindling)

b. Air Force Form 1028

(1) Will be used to prepare a graphic plan for each major building or group of buildings, including the flight line, POL facilities and open storage areas.

Stress the importance that prefire planning plays in Air Force fire protection

Use Charts #CC75-85, Prefire Plan (Front)
#CC75-86, Prefire Plan (Back)

(2) A graphic plan will be drawn on the reverse side of the form to include (12) items of information.

(a) Life hazards in each building and the most logical means of rescue

(b) Interior and exterior exposures

(c) Location of flammable storage, explosives and hazardous operations

(d) Location of hydrants or other water sources, including the amount of water available

(e) Type and detail of construction such as false ceilings, and advantageous areas of ventilation

(f) Show the best approach to the facility

(g) Specify the cut off of utilities, where, how, and by whom.

(h) Consider seasonal changes, their effect on accessibility and time factors

(i) Indicate installed systems, including location and procedures for correctly positioning pumpers

(j) Prepare maps showing routes, roads, trails to all points within traffic pattern.

(k) Trace routes and areas in locations subject to heavy
s snowfall

(l) Appropriate fire protection symbols contained in section (20) NFPA Fire Protection Handbook

INTERIM SUMMARY

c. Aircraft Pre-Fire Plan

(1) Plans will be developed on each type of mission assigned aircraft and on any transit aircraft by type that lands and takes off from the base on an average of seven times a week during any three month period

(2) Separate plans for runway or ramp situations will be developed for each of the following situations

(a) Engine fires

(b) Overheated brakes, with fire

(c) Fires in fuselage

(d) Wheels up landing, with fire

(3) The reverse side of AF Form 1028 (Pre-Fire Plan) will be used to prepare a graphic plan of the aircraft, and will include

(a) Optimum vehicle positioning, including rescue and resupply vehicle

(b) Pre-designated rescueman duties

(c) Tools and appliances for the rescue/suppression operation peculiar to the aircraft in question, (ladders, saws, disarming tool, etc.)

(d) Average number and location of aircrew and passengers expected.

(e) Expected surface fuel flow direction

(4) Aircraft pre-fire plans will be carried on each fire chief's vehicle, assistant chief's vehicle, and a copy will be maintained in the fire station

(5) The plans will be used for training and as a reference for fire protection techniques peculiar to the aircraft involved.

(6) The fire chief is responsible for the preparation of AF Form 1028

Application: TIME: N/A

Evaluation: TIME: 10 min

Interspersed throughout the presentation.

CONCLUSION TIME: 5 min

Summary: We have just completed our discussion on pre-fire plans. Pre-fire plans are a very important part of a fire department. They enable each fireman to have a plan of action in his mind before he actually gets to the scene of an emergency, some of the items on the pre-fire plans are, location, physical layout, water supply, and occupancy. Pre-fire plans are made up on each building on base, areas, and aircraft.

Remotivation: When you get to your next assignment, make it a point to study your pre-fire plans. You will find that by knowing the pre-fire plans you will be better equipped to do your job when the alarm sounds, with confidence and efficiency.

Assignment: N/A. Continue with Miscellaneous Rescue.

Closure: Remember the importance that pre-fire planning plays in the Air Force.

MISCELLANEOUS RESCUE

INTRODUCTION

TIME: 5 min

Attention: The alarm has sounded, you are responding to a vehicle accident. What is the most important thing you will have to do upon arrival? You think back to all the methods of vehicle rescue you have been trained in and hope you remember it all, for now the training is over, this is the real thing. Will you be able to perform as well as you should?

Review: We have just completed the lesson on pre-fire plans and know the importance they play in planning an attack on a fire or emergency.

Overview: Today we will have a lesson in various types of rescue situations that may arise, including automobile, natural disaster and water rescue.

Motivation: We never know what type of emergency situation we may face. Therefore, we must be prepared to cope with any type of emergency that might arise.

Transition: Today's lesson will begin with miscellaneous rescue procedures.

BODY

TIME: 3 hrs 50 min

Presentation:

TIME: 1 hr 50 min

1. Without reference, identify procedures for rescuing personnel from miscellaneous areas and disasters. Eighty percent of the procedures must be identified correctly.

Stress energy and materials conservation

   a. Procedures

Use WB 304

      (1) First remove victim to safety

      (2) Give first aid needed

      (3) The general rule that no victim should be moved before given first aid can be disregarded if the victim's life is in danger

b. Water rescue equipment

Use any article that will float

- (1) Boats
- (2) Life rafts
- (3) Canoes
- (4) Scuba equipment
- (5) Resusciatators
- (6) Compressable bags
- (7) Life lines (such as ropes)

c. Types of natural disasters

- (1) Floods
- (2) Earthquakes
- (3) Hurricanes
- (4) Tornadoes
- (5) Lightning storms
- (6) Thunderstorms

d. Prime responsibility

- (1) Survive and help others to survive
- (2) Assist in restoring operations on base
- (3) Support neighboring communities
- (4) Comply with 355 plan

INTERIM SUMMARY

Show Film: CFL 032, "Collision Rescue"

2. Using a salvaged automobile, P-10 rescue vehicle and mounted equipment, perform normal and emergency entry into a vehicle IAW locally established procedures, while strictly adhering to all applicable safety procedures. Operate tools and equipment as required.

Use TO 36A12-12-13-1

No smoking on hangar floor

a. Normal entry

- (1) Open doors
- (2) Depends upon position and condition

b. Emergency Entry	
(1) Remove windshield	Do not cut salvaged automobile
(a) Remove metal trim	
(b) Remove rubber seal	
(c) Windshield can be removed in one piece	Wear gloves
(2) Break rear window	
(a) One sharp blow in corner	
(3) Pry axe to force door	
(4) Use K-12 to cut corner post and remove roof	Use: Helmet Gloves
(a) Not to be used if gasoline is spilled due to production of sparks	
(5) Use air chisel to cut roof for access	
(6) Use PTO winch	Check vehicle for sharp or jagged metal; correct or report to supervisor as safety hazard
(a) Pull open car doors	
(b) Pull away crushed corner post	
(c) pull jammed seats from dashboard	

INTERIM SUMMARY

3. Using a salvaged automobile, rescue dummy, P-10 rescue vehicle and mounted equipment, perform rescue from a vehicle. Rescue must be in accordance with locally established procedures while observing all applicable safety practices. Operate tools and equipment as required.	Use salvaged automobile, P-10 and Mounted Equipment Use rescue dummy
a. Gaining access to victim	
(1) Depends on the location and position of the vehicle	Use extreme care when working in salvaged automobile
(2) May be as simple as opening the door, or as difficult as cutting the roof	No Smoking on the hangar floor

b. Conduct primary survey

  (1) Initiated when necessary while the victim is still in the car

  (2) Primary survey consists of:

    (a) Establishing and maintaining an airway

    (b) Giving artificial respiration

    (c) Controlling bleeding

c. Disentanglement

Stress Safety

  (1) Prevent further injury to the victim

  (2) Vehicle may have to be removed from around victim

  (3) Use extreme care when using tools and working around victim to accomplish disentanglement

d. Preparation for removal

  (1) Immobolize all fractures and dress all wounds

  (2) Correct all life-threatening problems

e. Removal

Return all equipment to proper location

  (1) Use extreme care

  (2) Transport to ambulance

Application:

TIME: 2 hrs

Interspersed throughout the presentation

2 INSTRUCTORS ARE REQUIRED

Evaluation:

TIME: 10 min

Intersperse throughout the presentation

CONCLUSION

TIME: 5 min

Summary: We have just completed our lesson on miscellaneous rescue. As firemen, we have to cope with many types of emergency situations. These may include building fires, automobile accidents, and natural disasters.

Remotivation: At any time we may be called upon for any type of miscellaneous rescue. Only with constant training can we stay ready.

Assignment: Read and study SG-305, Alarm Room Procedures and Operation, and answer the questions at the end of the unit.

Closure: Properly trained personnel are a must for fast and efficient rescue during any emergency situation.

ALARM ROOM PROCEDURES AND OPERATION

INTRODUCTION

TIME: 5 min

Attention: The house lights come on and the bell starts to ring. Where are you going? What type of emergency is it? Before this sequence started, the alarm center operator was already at work.

Review: We have just completed our lesson on pre-fire plans and miscellaneous rescue. All of these procedures will be valuable to you throughout your career as an Air Force fire protection specialist.

Overview: Today, we will discuss the purpose of the fire alarm center and how the alarm center operator operates it. We will discuss receiving and recording incoming information, relaying the information, establishing location and nature of emergencies, dispatching equipment, maintaining the activity log, observing all security precautions in voice communication, using the grid map, and learning simple facts to develop pre-fire plans.

Motivation: The fire alarm center operator must monitor the equipment under his control at all times. He is an important link in the fire department chain, which can only operate efficiently with precise information.

Transition: Today's lesson begins with the basic operation of the fire alarm room.

BODY

TIME: 5 hrs 50 min

Presentation:

TIME: 1 hr 40 min

1. Without reference, identify operational procedures of the alarm and communication center with 80% accuracy

   a. General principles

      (1) Before a firefighter can be assigned to the alarm and communication center, they must have a working knowledge of all aspects of the fire department

      (2) The alarm center is manned 24 hours a day. Personnel on duty are required to be alert and ready at all times

      (3) No one procedure or operation is more important than another

Show Film TVL 57-18, "Alarm Room Procedures"

Stress energy and materials conservation

Use WB 305

(4) The center operator is responsible for all functions of the alarm center

b. Operator related duties

(1) Maintain, receive and record information from normal and emergency communication systems

(2) Alert firefighting personnel and support agencies

(3) Dispatch equipment, inform personnel of location and nature of emergencies

(4) Provide pertinent information on emergencies as required.

(5) Maintain fire station logs

(6) Maintain and read maps, charts and status boards

2. Given an alarm and communication center trainer, monitor, receive, and record one normal and one emergency message. Proper communication procedures must be utilized in accordance with locally established policies, and all messages must be correctly recorded in less than three minutes.

2 Instructors are required for the .5 hr demonstration

a. Administrative telephones

Use Trainer #4041, Fire Department Communications Center

(1) Normally will consist of two or more extensions

(2) Permits the effective conduct of normal administrative business

(3) Procedure for answering this phone is: "Fire Department, Rank, Last Name, Speaking, Sir."

(4) Information received may be recorded on normal recording board.

(a) Name of person calling

(b) Date and time of call

(c) Pertinent information

(d) Center operators name is required on this board

b. Reserved emergency line telephone

Chart CAFB 73-128, "Reserved Emergency Line Telephones"

(1) Air Force adopted number is 117

(2) Procedure for answering this phone is: "Are you reporting a fire?"

(3) Always remember to remain calm when answering this phone. If person calling is excited, spend the time to calm them down in order to get the necessary information

(4) Necessary information is listed on structural emergency recording board

Chart CC 75-54, "Structural Recording Board"

(5) (a) Time

(b) Location

(c) Type of fire and/or emergency

(d) Life hazards

(e) Name of person calling

c. Fire reporting telephones

Chart CAFB 73-124, "Fire Reporting Telephone"

(1) A "direct" line to the fire department from where the phone is located

(2) Located in high hazard and isolated areas

(3) Procedure for answering this phone is: "Are you reporting a fire?"

(4) Use a "recording board" to record the information

d. Primary crash telephone

Chart CAFB 73-125, "Primary Crash Phone System"

(1) Used only for reporting aircraft incidents or emergencies

(2) Direct line from the Control Tower connecting Alarm Center, Base Operations, and hospital

(3) Procedure for answering this phone is: Pick up the phone and listen, recording all information given out; you will probably be required to acknowledge that you received the information by giveing your initials or some other means

(4) Aircraft emergency recording board

Chart CC 75-55, "Crash Recording Board"

(a) Type of aircraft

(b) Type of problem

(c) Number of personnel aboard

(d) Amount of fuel

(e) Landing on what runway and how long before landing

e. Secondary crash telephone

Chart CAFB 73-126, "Secondary Crash Phone System"

(1) Used to advise all supporting activities of the incident or emergency involving an aircraft

(2) Direct line from Base Operations connecting the supporting agencies such as Fire Department, Security Police, EOD, etc.

(3) Procedure for answering this phone is: same as for primary telephone. It is also acknowledged in the same manner.

INTERIM SUMMARY

f. Automatic alarm system

Use Trainer #4041, Fire Department Communications Center

(1) Usually located in areas with high life hazards or critical materials

(2) Activated by a device that will react to heat, light or smoke

   (3) When this type of alarm comes in, it will sound an automatic warning bell, and will record the location of the fire on tape by making a mark or punch

g. Two classes of alarm systems

   (1) Coded - will identify a building or particular section. The alarm transmitter sends an electrical impulse to the bells and is received in the alarm center by a receiving mechanism.

   (2) Noncoded - will usually identify only an area, although it could identify a building. The alarm will sound in the area protected and lights will flash in the alarm center showing location.

3. Given an alarm and communication center trainer and three messages, alert firefighting personnel and support agencies, dispatch equipment, inform personnel of location and nature of emergencies, and provide pertinent information on emergencies as required. Proper communications procedures must be utilized in accordance with locally established policies, and all actions must be completed in less than two minutes.

a. Alert firefighting personnel and support agencies

Use Trainer #4041, Fire Department Communications Center

   (1) Station alarm used to alert personnel

   (2) Alarm bells or other loud signaling device

   (3) Usually a specifically marked on/off switch is used to activate the device

b. Intercommunication

Use Trainer #4041, Fire Department Communications Center

   (1) Intercom system - to relay telephone or radio messages within the station. It is usually a system tied in with the telephone setup.

(2) PA system (public address) - to relay pertinent messages to personnel, and announce any general information deemed necessary by the fire chief. (Note: Intercom usually replaces its use after normal duty hours (1630 hours))

c. Dispatch equipment

Use Trainer #4041, Fire Department Communications Center

(1) Use the two way radio to inform personnel of location of emergencies and provide pertinent information on emergencies as required

(2) Be sure to always speak clearly, use a normal tone of voice, never discuss classified information, and never use obscene language

(3) Pronounce words clearly and use the phonetic alphabet and 10 code

(4) Phonetic alphabet and 10 code are located in alarm room

d. Response cards are a primary aid to the alarm center operator

(1) Card will tell the operator the type, number, and from which fire station the trucks will respond

(2) These cards are for certain areas on and off base

INTERIM SUMMARY

4. Given an alarm and communication center trainer and two messages, maintain fire station logs. Information must be logged with minimum instructor assistance in accordance with locally established policies.

a. Fire station log

(1) This log will be prepared by hand and entries made in a bound ledger type book. It covers events in the fire department for 24 hours.

(2) Information recorded should include personnel duty assignments, vehicle status, emergency responses, false alarms, training exercises, injuries, names of visitors, etc.

(3) All emergencies will be entered in the book in RED ink. All other information should be entered in black ink.

(4) If more than one alarm center exists an activity log will be maintained for each one

5. Given an alarm and communication center trainer, maps, charts, status boards, and selected messages, read and maintain maps, charts, and status boards in accordance with locally established policies. All tasks must be completed in less than five minutes.

a. Maintain and read maps, charts, and status boards.

(1) Purpose - primary purpose of Air Force fire department grid maps is for use on off-base emergencies

Use Chart CAFB 69-112, "Grip Map"

(2) Lines are drawn on grid maps both vertically and horizontally forming squares. The lines are numbered across the bottom, and lettered across the sides.

(3) To read the grid map, begin by reading across to the number and then up to the letter. ("Right and up").

(4) The off-base grid map covers a fifteen (15) mile radius around the base.

(5) Grid overlay - used to pinpoint an area within a grid map square

b. Charts and status boards

Vehicle status
Water distribution

(1) Many types of charts and status boards are used in the alarm center

(2) Each one has a specific use and is developed at base level

Application TIME: 4 hrs

2 INSTRUCTORS ARE REQUIRED

Intersperse throughout the presentation

Evaluation: TIME: 10 min

Intersperse throughout the presentation

1. The alarm center is manned how many hours a day?

   24

2. What is the Air Force adopted number for reporting fire?

   117

3. What are the two classes of alarm systems?

   Coded and Non-Coded

4. Who is responsible for relaying information?

   The center operator

5. What is the radius of an off-base grid map?

   15 miles

CONCLUSION

TIME: 5 min

Summary: We have discussed the fire alarm center and its function as an integral part of the fire department. You have seen the importance of having an efficient fire alarm center operator who knows his job, which includes receiving and recording incoming information, relaying information, establishing location and nature of emergencies, locating points on a grid map, and dispatching equipment.

Remotivation: You could possibly be an alarm center operator at your next base or at least spend some time in the alarm room. To be a part of an effective firefighting unit, you must know how to operate the fire alarm center, among your other duties.

Assignment: Review and study SG-304, Miscellaneous Rescue.

Outside Assignment: (2 hours) Read and study SG-306, Structural Firefighting Accessories and answer the questions at the end of the unit.

Closure: As mentioned earlier, the fire alarm center and its operator is a very important link in the fire department chain. Now, you have an idea what role it plays in the chain.

STRUCTURAL FIREFIGHTING ACCESSORIES

INTRODUCTION

TIME: 5 min

Attention: You are a member of a crew at the scene of a fire. A man working from the third floor requests a tool to be hoisted up to him. He lowers a rope to you to be used to secure the tool. You had better know how to secure the tool with the rope so that he can raise it up to himself for instant use.

Review: As you remember, yesterday we discussed the fire alarm center, the types of communications equipment, and how they are put to use by the alarm center operator.

Overview: Today, we will have a discussion on the purpose of fire service rope, its size, and the use of knots and hitches. We will also discuss the type of ladders we use in the Air Force, and their component parts.

Motivation: Ropes and ladders are a necessary part of fire department equipment. When they are needed, there is no other equipment that can be substituted. As a member of a structural crew, you must know the correct uses of each.

Transition: Today's lesson begins with the basic knots and hitches used in the Fire Protection field.

BODY

TIME: 5 hrs 50 min

Presentation:

TIME: 2 hrs 40 min

1. Using a 3/4" rope, tie four (4) types of knots and three (3) types of hitches. Knots and hitches will be tied in accordance with the WB procedures with minimum instructor assistance.

Stress energy and materials conservation

Check Outside Assignment

Use WB-306

a. Purpose

(1) Safety lines

(2) Rescue

(3) Hoisting

(4) Anchoring

b. Size and type

(1) 3/4" x 100'

(2) Manila hemp

c. Terms

(1) Bight - formed by simply bending the rope, or doubling it back keeping the sides parallel

(2) Loop - formed by crossing the sides of the bight

(3) Knot - a series of loops and bights forming a secure tie to another object

(4) Hitch - a loop or loops. It is a more temporary form of a knot

d. Types of knots and hitches

(1) Half hitch

(a) Used as a safety measure

(b) Used in conjunction with other knots and hitches

Use Chart 67-189, "Half Hitch"

(c) Never used by itself

(2) Clove Hitch - used in hoisting tools and equipment. (Fire extinguisher, pike pole, hose, etc.)

Use Chart 67-189, "Clove Hitch"

Use Chart 67-192, "Extinguisher and Pole Hoist"

(3) Square Knot - used to join two ropes of equal diameter

Use Chart 67-190, "Square Knot"

(4) Becket bend - used to join two ropes of unequal diameter

Use Chart 67-190, "Becket Bend"

(5) Bowline

Use Chart 67-191, "Bowline"

(a) Used to make a secure loop in the end of a rope

(b) Used in hoisting a roof ladder

(6) Double bowline - used for rescue to lower victim from upper structures. It has three (3) loops in it; one for each leg, and one to go around the chest

(7) Axe Hitch - used to hoist or lower an axe

Use Chart 67-193, "Axe Hitch"

e. Tie knots and hitches

  (1) Half hitch

  (2) Clove hitch

  (3) Square Knot

  (4) Becket bend

  (5) Bowline

  (6) Double Bowline

  (7) Axe hitch

Stress proper knot tying for safety and security of equipment and personnel

INTERIM SUMMARY

2. Given various types of fire protection hand tools and equipment, use ropes to tie tools and equipment for hoisting. Knots will be tied in accordance with the WB procedures with minimum instructor assistance.

Use: Length of rope 3/4 " diameter, 2 1/2 gallon fire extinguisher, fire hose 2 1/2 " x 50 feet, roof ladder, axe, pike pole, 2 1/2 inch nozzle

a. Use proper safety procedures while using ropes

  (1) Make sure all knots and hitches are secure enough to hold

  (2) Never stand underneath equipment being hoisted or lowered

Stress safety

Use: Structural Firefighting Vehicles and Mounted Equipment

3. Given common structural firefighting tools and equipment, inspect and perform operator maintenance on tools and equipment. Procedures listed in the WB must be followed with minimum instructor assistance.

a. Tools and equipment

  (1) Pick head axe

    (a) Check head for nicks

    (b) Check for rust

    (c) Apply light coat of oil

    (d) Check handle for splinters, cracks, rot

    (e) Sand smooth and apply light coat of linseed oil

- (f) Check handle for security

(2) Pike Pole

- (a) Check hook for security
- (b) Check handle for splinters, cracks, rot
- (c) Sand smooth and apply light coat of linseed oil

(3) Bolt cutters

- (a) Check jaws for nicks
- (b) Check for ease of operation
- (c) Grease moveable joint if needed

(4) Hydrant wrench

- (a) Check threads for ease of operation
- (b) Remove rust and grease threads

(5) Hose Calmp

- (a) Check for bent handle
- (b) Check for worn teeth
- (c) Remove rust and repaint

(6) Extension ladder

- (a) Check halyard for fraying
- (b) Check pawls for free operation
- (c) Check for broken steps
- (d) Inspect all moveable parts of ladder

(7) Roof ladder

- (a) Check for damage, bends
- (b) Check hooks for smooth operation

4. Given a structural firefighting vehicle, perform ladder operations to include remove, carry, position, raise and climb ladders. All procedures in the WB must be strictly adhered to while observing all applicable safety procedures.

Use: Roof Ladder
Extension Ladder

a. Types and sizes

(1) Roof ladder

(a) A ladder built in one section, equipped with special hooks at the top of it

(b) 14' in length

b. Carrying method

(1) One man carry

(2) Standing in opposite direction of desired travel, pick up the ladder with one hand by the beam and balance

(3) Having lifted the ladder, turn in the direction of travel, passing arm between the fifth and sixth rung, grasping the second rung forward. Allow beam to rest on shoulder

(4) Top should be carried forward and slightly tilted downward

c. Raising and spacing ladders

(1) Roof ladder

(a) Place butt of ladder against building

(b) Grasp top rung and raise ladder to a vertical position

(c) Walking toward the butt, grasp every other rung until the ladder is in an upright position against wall.

(d) Grasping the second and fifth rungs, lift ladder off ground carrying it back to desired distance.

(e) Proper spacing angle is one-fifth plus two feet of the extended ladder in use.

d. Extension ladder

(1) A ladder built in two or more sections; or a ladder with one bed and one or more flys

(2) 24, 35 and 36 feet in length

(3) Component parts

(a) Bed ladder - the lowest section of an extension ladder

(b) Fly ladder - the uppermost part of an extension ladder

(c) Butt, heel or foot - the bottom end or ground end of a ladder

(d) Tip or top - the top of a ladder

(e) Beam - the principle structure member of a ladder in which the rungs are supported

(f) Rungs - the cross member of the beam which is used in climbing

(g) Heelplate - metal channel reinforcement at the butt end of a ladder

(h) Halyard (fly rope) - used to hoist the fly of an extension ladder

(i) Pawl or dog - a lock used to support the fly of an extension ladder after it has been raised

(j) Stops - metal blocks used to prevent the fly of an extension ladder from being extended out of the main ladder

(k) Guides - light metal strips on an extension ladder which guide the fly while it is being raised or lowered

e. Extension ladder

Use Chart 67-198, "Ladder Carries"

(1) Two man carry

(a) Place ladder on beam

(b) Face opposite direction of travel

(c) Lift ladder at each end by beam, turning in direction of travel. Pass free arm through ladder grasping second rung forward, allow beam to rest on shoulder

(d) Butt end should be carried forward

(2) Four man carry

(a) Place ladder on ground with fly up and butt forward

(b) With a man on each end and on opposite sides, reach down and grasp a rung. Remember to be facing in the opposite direction you want to travel

Use commands: Prepare to lift, lift; prepare to lower, lower. Promotes smooth and efficient operation.

(c) Raise the ladder turning into it and facing the direction you want to travel

(d) Butt end should be carried forward

f. Extension ladder (Three man)

Watch for electrical power lines

(1) Using one-fifth plus two feet of the extended ladder to be used, proper spacing angle is obtained prior to laying the ladder on ground with flys in the up position. Purpose of proper spacing is to place ladder in a more stable position

(2) One man stands on heel plate reaching forward grasping a rung with both hands, leans back and assists in raising	
(3) Two men will space themselves about one-third from the top of the ladder facing the top. They will reach down and grasp a rung turning into the ladder as they bring it off the ground so that they will be facing the butt after lifting	
(4) Walk ladder to upright position grasping every other rung as they do so	High winds make ladder raising difficult
(5) Two men will grasp ladder by beams, pivoting the ladder until the flys are on the climbing side	
(6) While two men hold the ladder in upright position by the beams, the third man will hoist the flys to the desired position using the halyard. Halyard should then be secured to a rung	
(7) All three men will then lean ladder into building	
g. Climbing and locking in procedures	Secure ladder to platform prior to letting students climb. Students will not remain on platform.
(1) Climbing - the ball of one foot or the other must be placed on each rung and in the center to prevent ladder from wobbling. Hands will grasp every rung when decending. The body should maintain an erect posture at all times	
(2) Locking in - place one leg between rungs and bring the foot out between the next lower rung locking the foot around a run or beam. Take other foot and step down one rung.	Prevents falling from ladders

h. Use proper safety procedures involving ladder operations

    (1) Make certain ladders are properly spaced to insure stability

    (2) Make certain ladders are properly secured or anchored. If working off an extension ladder on an upper floor of a structure, be sure ladder is anchored by the use of a rope

    (3) Make certain pawls are locked.

Application: TIME: 3 hrs

2 INSTRUCTORS ARE REQUIRED

Intersperse throughout the presentation.

Evaluation:

Intersperse throughout the presentation. TIME: 10 min

1. What is the purpose of the becket bend?
   Used to tie two ropes of unequal size.
2. What is a bowline? Used to make a secure loop on the end of a rope.
3. When hoisting a roof ladder, what kind of knot is used?
   A bowline.
4. What types of hitches are used to hoist a pike pole?
   A half hitch and a clove hitch.
5. To tie two ropes of equal size, what knot is necessary?
   Square knot.
6. When hoisting a roof ladder the bowline is placed on the ladder in what position?
   One third from the top.
7. What kind of knot or hitch would be used to lower a victim from upper structures?
   Double bowline.
8. What is an extension ladder?
   A ladder of two or more sections.
9. What is the upper section of an extension ladder called?
   Fly.
10. What is the formula used for spacing a ladder?
    One fifth plus two feet.
11. How many men are used to raise the extension ladder?
    Three.

CONCLUSION TIME: 5 min

Summary: Today, we have discussed the purpose and size of ropes we use in the fire department in the Air Force. We discussed the use of knots and hitches, size, type and parts of fire service ladders, and performed operations using ropes and ladders. You were also made aware of certain safety procedures when using ropes and ladders.

Remotivation: Ropes and ladders form a part of any fire department equipment, and their correct use can mean the difference between life and death.

Assignment: Read and study PT-307 and answer the questions. Have students to review all materials and notes in preparation for the Block III final measurement test.

Outside Assignment: (2 hrs) Read and study SG-307, Fire Protection Hydraulics and answer the questions at the end of the unit.

Closure: It is very possible that you may never need to use ropes or ladders very often after you leave this school. If necessary, however, you will be able to quickly do what is necessary with ease and assurance.

FIRE PROTECTION HYDRAULICS

INTRODUCTION

TIME: 5 min

Attention: You have just been at your new position of driver-pump operator for a few days. You are proud of yourself, and even more proud when on an alarm you drive your vehicle to the fire safely. You are performing well until suddenly you must operate the pump on your vehicle to get water to the fire, and you forget how to determine your pump pressure. You never thought this situation would arrive so soon and are not as proficient in your new position as you should be and led others to believe.

Review: Yesterday, we discussed firefighting accessories, and you learned the importance of being able to tie the proper knots and hitches. You also learned how to make use of roof and extension ladders.

Overview: During the next few hours we will discuss a facet of fire department hydrauli which will include a definition of all terms, finding out how firemen will utilize the pump operators guide plate, and the rule of thumb and discuss the principles of drafting.

Motivation: Soon we will be working with hose and water under pressure. To little pressure produces an ineffective fire stream, while too much might make the nozzleman's job of handling the nozzle impossible. With the correct pressure, a nozzleman can fight any fire easily and effectively.

Transition: Today's lesson begins with terms and definitions of hydraulics.

BODY

TIME: 3 hrs 50 min

Presentation:

TIME: 1 hr 50 min

1. Without the aid of references, identify principles of hydraulics as they apply to fire protection. Eighty percent of the principles must be identified correctly.

    a. Terms and definitions

        (1) Hydraulics - a science that deals with the properties of liquids at rest or in motion

        (2) Pounds Per Square Inch (PSI) - the amount of pressure that will be exerted on hose (from the inside) or the pressure at which water is discharged through a nozzle.

Stress energy and materials conservation

Check outside assignment

Stress importance of providing proper and safe fire streams to prevent injury to personnel and damage to equipment

Review PT-307

(3) Gallons Per Minute (GPM) - amount of water being discharged through an opening in one minute.

(4) Friction Loss (FL) - as water is forced through hose or piping we have a loss of pressure due to its rubbing against the inside lining.

(5) Standard Nozzle Pressure (SNP) - desired pressure at the nozzle that can be handled by one person and will produce an effective fire stream; 50 PSI for solid stream, 100 PSI for fog stream nozzles.

(6) Fire Stream - with SNP maintained an effective stream will discharge 9/10 of its volume in a 15" circle or 3/4 of its volume in a 10" circle, at 50 ft, we may then say we do not have an excessive loss of volume.

(7) Pump Pressure (PP) - pressure required at the pump to overcome FL to maintain SNP. We arrive at PP by adding the FL to the SNP (PP = FL + SNP).

(8) Pump Operators Guide Plate - a small plate mounted in the pump compartment which gives a quick reference of the exact pump pressure required. To use the guide plate the length of hose and nozzle size in use must be known.

Chart CAFB 64-539, "Pump Operators Guide Plate"

(9) Rule of Thumb - a method used to give a quick approximation of pump pressure. As with the Guide Plate nozzle size and hose length must be known; however, the friction loss must be mentally calculated.

(10) Back Pressure - that pressure exerted back against a pump or hydrant when pumping to multi-story buildings or uphill, as a rule of thumb 5 psi is used for every 12 feet (one story) increase in elevation.

(11) Water - this liquid is our most common extinguishing agent. Water is the basis for all fire protection hydraulic problems. For our purpose, water is noncompressible and has a weight of approximately 8.3 lbs per gallon. Water has a greater heat absorbing capacity than other common extinguishing agents. At 212 degrees fahrenheit, a cubic foot of water expands approximately 1,700 times its original volume.

b. Using the pump operators guide plate, students will determine the correct pump pressure when using the 1", 1-1/8" and 1-1/4" tips.

Use Chart CAFB 64-539, "Pump Operators Guide Plate".

(1) Provides quick exact pump pressure when hose length and tip size are known.

(2) Friction loss and nozzle pressure are pre-calculated.

(3) Items found on guide plate:

(a) Nozzle size

(b) GPM

(c) Nozzle pressure

(d) Exact pump pressure

(e) Desired Position of Change-over valve

(f) Hose length in 100 ft. increments

(4) When pumping to multi-story buildings, add 5 psi for every floor excluding the first floor.

Given hose length and nozzle size, student will figure friction loss and pump pressure using the rule of thumb method.

(1) Quick approximate calculation of pump pressure

(2) In order to compute rule of thumb problems, each individual should know and understand the following chart.

Tip Size	Friction Loss Per 100 Ft of 2½" Hose.	GPM
1"	10 psi	209
1-1/8"	18 psi	265
1¼"	25 psi	326

(3) To get the pump pressure, you multiply the friction loss as determined by the nozzle used, and then by the hose length divided by 100 then add standard nozzle pressure -

$$\mathrm{FL} \times \frac{\mathrm{HL}}{100} + \mathrm{SNP} = \mathrm{PP}$$

(4) Back pressure - add 5 psi for each floor above first.

(5) To determine the total GPM flow multiply the discharge rate of the tip or tips used by the minutes the nozzle has operated.

d. Wying 2½" Hose Down to 1½" Hose.

(1) Used for maneuverability

Less water damage from smaller line.

(2) Friction loss (2½" hose) 6 psi per 100 ft.

(3) Usually 150' of 2½" hose on each line of wye.

(4) Friction less (1½" hose) 20 psi per 100 ft.

(5) Based on 75 GPM and 100 PSI nozzle pressure.

e. Siamesing two 2½" lines into one 2½" line

(1) Reduces friction loss.

(2) Friction loss from siamese, use the rule of thumb or guide plate.

(3) To figure friction loss from pump to siamese, figure only one line (longest), take ½ of this friction loss, add to friction loss for single line plus SNP = PP.

f. Master streams - are used when large volumes of water are needed at high pressure.

Minimum of two lines for master streams

(1) Master stream usage

(a) Water curtains

(b) Cover the bulk of fire with straight or fog streams

(c) Cool heated areas above fire to reduce updrafts

(2) Master stream nozzle sizes and GPM

(a) Based on 80 PSI nozzle pressure

1½" tip	600 GPM
1-3/4" tip	800 GPM
2" tip	1000 GPM

(3) Computing for master streams

(a) Using rule of thumb

1. Divide GPM by number of supply lines

2. Use rule of thumb for 1", 1-1/8" and 1¼" tip.

To determine friction loss in hose lay

3. Add 80 PSI nozzle pressure

4. Add 15 PSI friction loss in master stream siamese

5. Set pump to this pressure

(b) Using pump operators guide plate

1. Divide GPM by number of supply lines

2. Add 45 psi

3. Set pump pressure

(5) Students will discuss what is meant by drafting and how it takes place

(a) Drafting as applied to fire protection means to obtain water from an alternate source such as lakes, rivers, etc., when a hydrant supply is not available

(b) This is accomplished by the use of a hard suction hose and a primer on the vehicle

1. Hard suction hose - prevents the collapse of lines.

2. Primer - Allows you to decrease pressure in hard suction hose.

(c) The hard suction hose is hooked to the intake of a vehicle and placed in the water source. The primer is then engaged causing a decrease of pressure inside our lines allowing the atmospheric pressure to push water into the pump. (A partial vacuum is created within the hard suction hose).

(d) Atmospheric pressure is that which is exerted in all directions and on all things. At sea level this pressure is 14.7 psi; however, it decreases at the rate of .5 for each 1,000 feet increase in altitude

(e) In a perfect vacuum at sea level, water could be raised 33.9 feet; however, our vehicles only have a capacity to draft to a height of 25 feet.

Application: TIME: 2 hrs

Intersperse throughout the presentation

Evaluation: TIME: 10 min

Intersperse throughout the presentation

CONCLUSION

TIME: 5 min

Summary: We have discussed the purpose and necessity for each firefighter to know fire protection hydraulics. We have defined terms and worked problems determining pump pressure, gallons per minute, and friction loss. We also discussed using the pump operators guide plate and the rule of thumb, and briefly went into a look at drafting water.

Remotivation: You must be able to use fire protection hydraulics if you ever hope to effectively fight a fire, and your knowledge of this subject can be invaluable to you and your crew.

Assignment: Read and study the following SG units and answer the questions at the end of each unit.

a. SG-401, Operations and Maintenance of Hydrants

b. SG-402, Emergency Response Activities.

Outside Assignment: (2 hrs) Read and study SG-403, Inspections, Maintenance, Mounted Equipment and Operations of the 530B/P-8 Structural Pumpers and answer the questions at the end of the unit.

Closure: Fire protection hydraulics is an important aspect of effective firefighting. You now have the basic understanding of it. It is up to you to advance your knowledge and remain proficient.

PREPARE THE MAN

STUDY GUIDE 3ABR57130-1-SG-300

Technical Training

17-2

Fire Protection Specialist

BLOCK III
STRUCTURAL FIREFIGHTING EQUIPMENT AND ACCESSORIES

17 July 1975

AIR TRAINING COMMAND

CHANUTE TECHNICAL TRAINING CENTER (ATC)

This supersedes 3ABR57130-1-SG-300, 3 March 1973.
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BLOCKS III AND IV ORIENTATION

OBJECTIVES

After completing this study guide and your classroom instruction, you will participate in a discussion on:

1. Block content.
2. Safety.
3. Energy conservation.

INTRODUCTION

Proficiency in the Fire Protection Organization can, in many cases, be the difference between life and death--your own, or that of the victim of a fire or an emergency. These two blocks of instruction will contain information essential to the duties of the Fire Protection Specialist. Included is material relating to structural firefighting, miscellaneous rescue, and vehicles.

INFORMATION

BLOCK CONTENT

The following subjects will be covered during this block of instruction.

Operations, Maintenance and Mounted Equipment on the P-10 Rescue Vehicle

Prefire Plans

Miscellaneous Rescue

Alarm Room Procedures and Operation

Structural Firefighting Accessories

Fire Protection Hydraulics

BLOCK RESPONSIBILITIES

You are responsible to your instructor at all times. Any questions you have can be referred to your instructor. If your instructor cannot answer a question, he will send you to the shift supervisor. Do not leave the class or the school without the permission of your instructor. You will be required to assist the cleaning of the fire equipment and facilities used during Blocks III and IV. This is the same type of cleaning and maintenance that you will perform at a fire station in the field.

CARE OF EQUIPMENT

The condition of the fire equipment often makes the difference between losing a building and saving one. Therefore, it is very important that fire equipment receive the best of maintenance and care. During the two blocks of instruction, you will be required to help clean and maintain the equipment you use.

SAFETY PRECAUTIONS

One of the most important items a fireman must remember is safety procedures. This applies to firefighting operations and activities around the fire station. Also, be very careful to follow the safety rules for riding, operating, and dismounting fire equipment.

ENERGY CONSERVATION

While you attend this course, energy conservation will be practiced to the fullest extent to include the use of classroom cleaning materials, room temperature and lighting when not in the classroom. While working on the vehicle, energy conservation will be practiced in regard to leaking vehicles (water, foam, gas and oil), overflowing tanks (water, foam and gasoline), cleaning materials (water, soap, wax and rags). Conservation of fuel can be practiced by operating the vehicle at low RPMs.

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QUESTIONS

Please answer questions on a separate sheet of paper. Please do not write in this training literature. Other students will use it after you.

1. Proficiency in the Fire Protection Organization can, in many cases, be the difference between __________ and __________.

2. You are responsible to your __________ at all times.

3. Do not leave the class or the school without the __________ of your instructor.

4. The __________ of the fire __________ often makes the difference between losing a building and saving one.

5. One of the most important items a fireman must remember is __________ __________.

6. While students attend this course, __________ __________ will be practiced to the fullest extent.

Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-SG-302

OPERATIONS, MAINTENANCE AND MOUNTED EQUIPMENT ON THE P-10 RESCUE VEHICLE

OBJECTIVES

After completing this study guide and your classroom instruction, you will be able to:

1. Perform inspection and operator maintenance on the P-10 rescue vehicle and mounted equipment.

2. Demonstrate the use of reinstall tools and operate equipment.

3. Perform preventive maintenance on the P-10 rescue vehicle and mounted equipment.

INTRODUCTION

The A/S32P-10 (hereafter referred to as the P-10) forcible entry rescue vehicles are all-weather rescue vehicles designed with urgency and maneuverability in mind. These vehicles are equipped to effect rescue from any given situation conceivable on an Air Force installation but may require supplementation with special items according to the local conditions. For years these vehicles have merely been another piece of equipment that, in many opinions, was not really needed. Fortunately, people's minds have changed through the efforts of firefighters concerned for the safety of others. The Air Force Fire Service is recognizing the importance of having a well trained, well equipped, rescue capability. You will find that practically any item required for rescue is available through ordinary supply channels and you should take enough initiative to secure these items. Your rescue vehicle, regardless of the type, is equipped with the bare minimum of equipment when it is received at your base. It must be supplemented according to the specific location and rescue problems expected.

INFORMATION

P-10 RESCUE VEHICLE

Fire protection is beginning to recognize the importance of trained or specialized rescuemen due to the many rescue situations and the increasing complexity of transportation equipment and structures. They now realize that it is not practical and is impossible for a regular firefighter to be assigned to both firefighting and rescue duties on the crossmanning concept. To keep abreast of rescue practices and techniques, it is necessary to be assigned to the rescue team constantly, to allow you to train in all the areas necessary and to keep abreast of new procedures and techniques in rescue. It is desired that the rescuemen be exempted from routine duties which do not pertain to rescue training. Remember that the rescueman is responsible for the actual rescue of the victims of accidents and if they do their job properly the firemen can concentrate on firefighting and support for which they are trained to do. For many years, rescue has taken a back seat to such things as laying hose, painting fire hydrants, live fires (training), testing fire hose, etc. This should not be. The saving of lives is our primary responsibility, then saving property, in that order.

Many rescuemen will be assigned to the rescue crew but will not perform in the manner expected of a rescueman. TRAINING is the big word in any section of fire protection but especially in rescue. You must be able to enter any building or aircraft quickly and by forcible means if necessary and effect rescue under the most hazardous conditions imaginable. You must be able to locate and recognize any given location within your response range immediately to reduce response time. You must be capable of removing victims from crashed automobiles without further injury. You must be able to perform first aid on the victims of accidents or sudden illnesses responsibly and proficiently. These are but only a few of the duties and responsibilities of a rescueman. Can you accomplish all these at the present time? You are getting paid to accomplish them but you must admit to yourself that you are unqualified, if you are unqualified. Only when you admit your weaknesses to yourself, will you start to increase your knowledge and eliminate your weak areas.

When you are dealing with life, you don't have a second chance. You must be qualified to perform rescue NOW. It will be too late to start training after someone is killed because you couldn't find a building, couldn't operate the winch on a rescue vehicle, or some other task which you should be able to perform. RIGHT NOW IS THE TIME TO START TRAINING.

Your rescue vehicle, rescue equipment, and training will determine to a great extent, if you succeed or fail in the rescue situation. You must be able to operate your vehicle safely, operate all items of equipment, whether standard or supplemented, with a minimum of delay, and take care of your vehicle and equipment when they are not in use. Rescue vehicles and equipment are important in your practical training because, without a thorough knowledge how to use these items, you cannot even train properly.

For a specific task in emergency rescue, there is always a specific tool that will accomplish the task best. The purpose of this study guide is to cover the general description of the rescue vehicle. Chances of rescue being performed at an emergency is always a factor. With this thought in mind, one might readily see the importance of knowing the equipment which will aid you most when engaged in rescue work. Knowing how to properly use these vehicles and equipment may, one day, mean the life or death of a trapped victim, maybe your best friend.

Reading Assignment

You should understand the A/S32P-10 rescue vehicle and mounted equipment in order to operate this vehicle effectively. Study the following reading assignment from TO 36A12-12-13-1.

Page	Paragraph
1-1 thru 1-7	1-5 thru 1-37
4-3 thru 4-8	4-12 thru 4-23
4-8 thru 4-11	4-27 thru 4-36

QUESTIONS

Please write your answers to the following questions on a separate sheet of paper.

1. The P-10 has __________ wheel drive.

2. All of the forcible entry and rescue equipment, except the __________ __________ __________, can be operated away from the truck.

3. The __________ provides fast and safe heavy duty cutting power without relying on auxiliary equipment.

4. Two portable engine-driven blowers are used to remove __________ and __________ from enclosed areas.

5. The engine-driven portable generator is used to furnish power for the __________ __________.

6. In operating the winch, put __________ and __________ case in neutral.

REFERENCES

1. TO 36A12-12-13-1, Firefighting Truck, Forcible Entry.

Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-SG-303

PREFIRE PLANS

OBJECTIVE

After completing this study guide and your classroom instruction, you will be able to identify basic facts concerning preparation of prefire plans.

INTRODUCTION

Many times, as a fire protection specialist, you will be called on to perform rescue or extinguish a fire in either buildings or aircraft. A primary aid in performing the tasks is prefire plans.

INFORMATION

PURPOSE

The purpose of prefire planning is to indoctrinate firefighters in known factors and to predesignate certain duties. Lack of knowledge may result in fatal or serious injury to fire protection personnel as well as those who require fire-suppression services.

PREFIRE PLANNING PROGRAM

A prefire planning program is implemented at all Air Force installations to insure effective fire response procedures. Plan for the following responses:

Each mission assigned aerospace vehicle.

Selected transient aerospace vehicles.

Mission essential facilities.

Missile sites and rocket pads.

Deluge or sprinkler-equipped facilities.

Facilities, regardless of occupancy, that present a unique fire-protection problem such as multistory facilities, clubs and schools.

Other facilities as determined by the fire chief.

Plans are prepared to explain procedures and other geographically important information, required during fire-suppression operations.

Where the fire situation permits, the initial attack with preconnected 1-1/2 inch hoselines may be desirable. Larger hose lines (such as 2-1/2 and 3 inch) are required when combating major fires, supporting master streams, sprinkler systems, and protecting exposures.

Building prefire plans are carried on the assistant fire chief's vehicle and each first-run pumper. Maintain a copy in each fire alarm communications center.

PREFIRE PLANNING FOR AEROSPACE VEHICLES

On each Air Force installation, each fire organization develops a prefire plan on each type of mission-assigned aircraft (installations that possess the aerospace vehicle inventory change AFM 65-110 mission support, and transient aircraft that land and take off, including touch-and-go landings from the same installation an average of seven times a week during any three consecutive month periods). Prepare AF Form 1028 to include:

Optimum vehicle positioning (including rescue and resupply vehicles).

Aircraft characteristics and information as indicated in TO 00-105E-9.

Predesignated rescuemen's duties.

Aircraft prefire plans are carried on each fire chief's vehicle, assistant chief's vehicle, and a copy is maintained in the fire alarm communications center.

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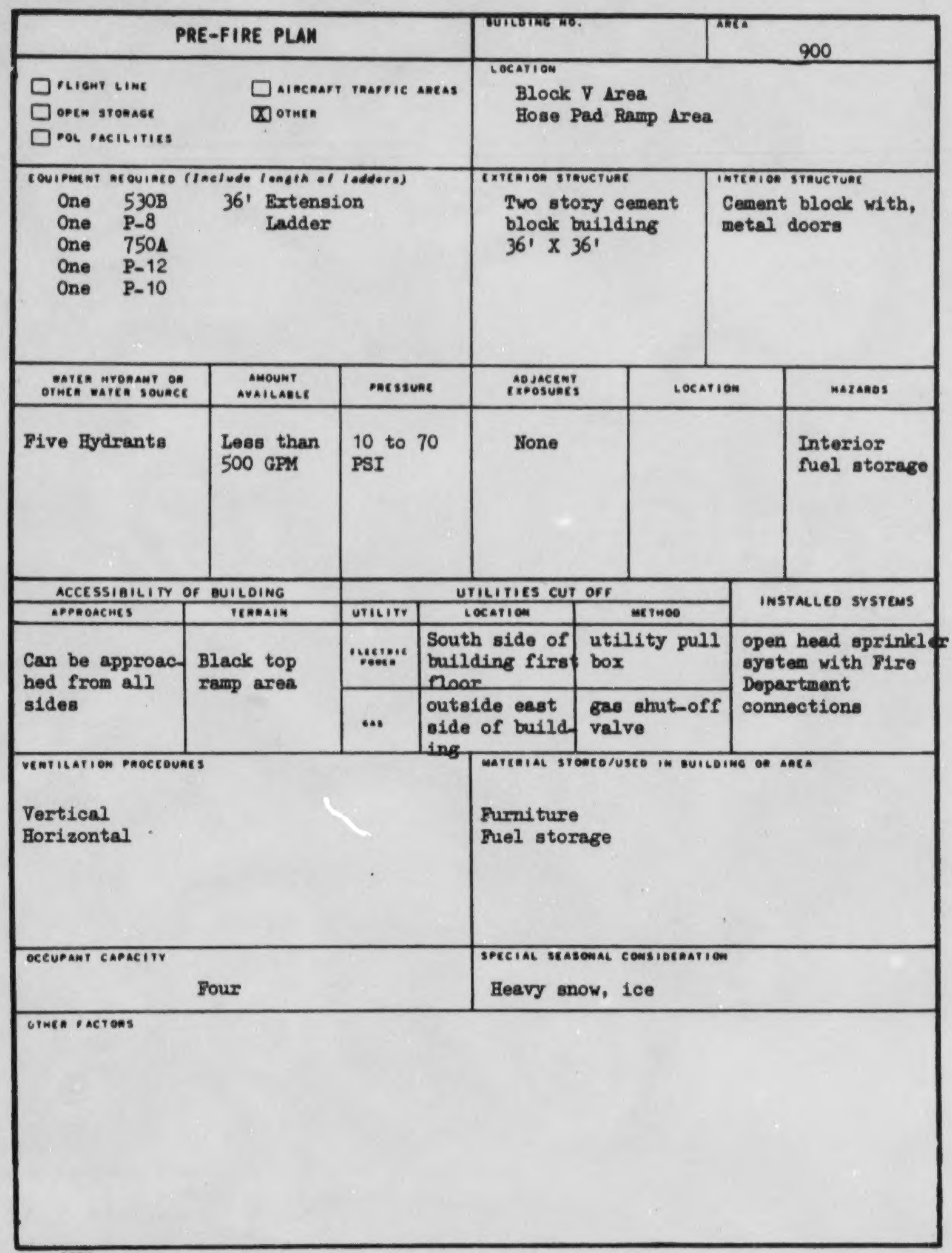

PRE-FIRE PLAN	BUILDING NO.	AREA 900
☐ FLIGHT LINE ☐ AIRCRAFT TRAFFIC AREAS ☐ OPEN STORAGE ☒ OTHER ☐ POL FACILITIES	LOCATION Block V Area Hose Pad Ramp Area	
EQUIPMENT REQUIRED *(Include length of ladders)* One 530B 36' Extension Ladder One P-8 One 750A One P-12 One P-10	EXTERIOR STRUCTURE Two story cement block building 36' X 36'	INTERIOR STRUCTURE Cement block with, metal doors

WATER HYDRANT OR OTHER WATER SOURCE	AMOUNT AVAILABLE	PRESSURE	ADJACENT EXPOSURES	LOCATION	HAZARDS
Five Hydrants	Less than 500 GPM	10 to 70 PSI	None		Interior fuel storage

ACCESSIBILITY OF BUILDING		UTILITIES CUT OFF			INSTALLED SYSTEMS
APPROACHES	TERRAIN	UTILITY	LOCATION	METHOD	
Can be approached from all sides	Black top ramp area	ELECTRIC POWER	South side of building first floor	utility pull box	open head sprinkler system with Fire Department connections
		GAS	outside east side of building	gas shut-off valve	

VENTILATION PROCEDURES Vertical Horizontal	MATERIAL STORED/USED IN BUILDING OR AREA Furniture Fuel storage
OCCUPANT CAPACITY Four	SPECIAL SEASONAL CONSIDERATION Heavy snow, ice
OTHER FACTORS	

AF FORM 1028

Figure 1. Front Side of AF Form 1028.

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DIAGRAM: *(Including location of doors, windows, stairways, with means of rescue outlined: location of hydrants or other water sources.)*

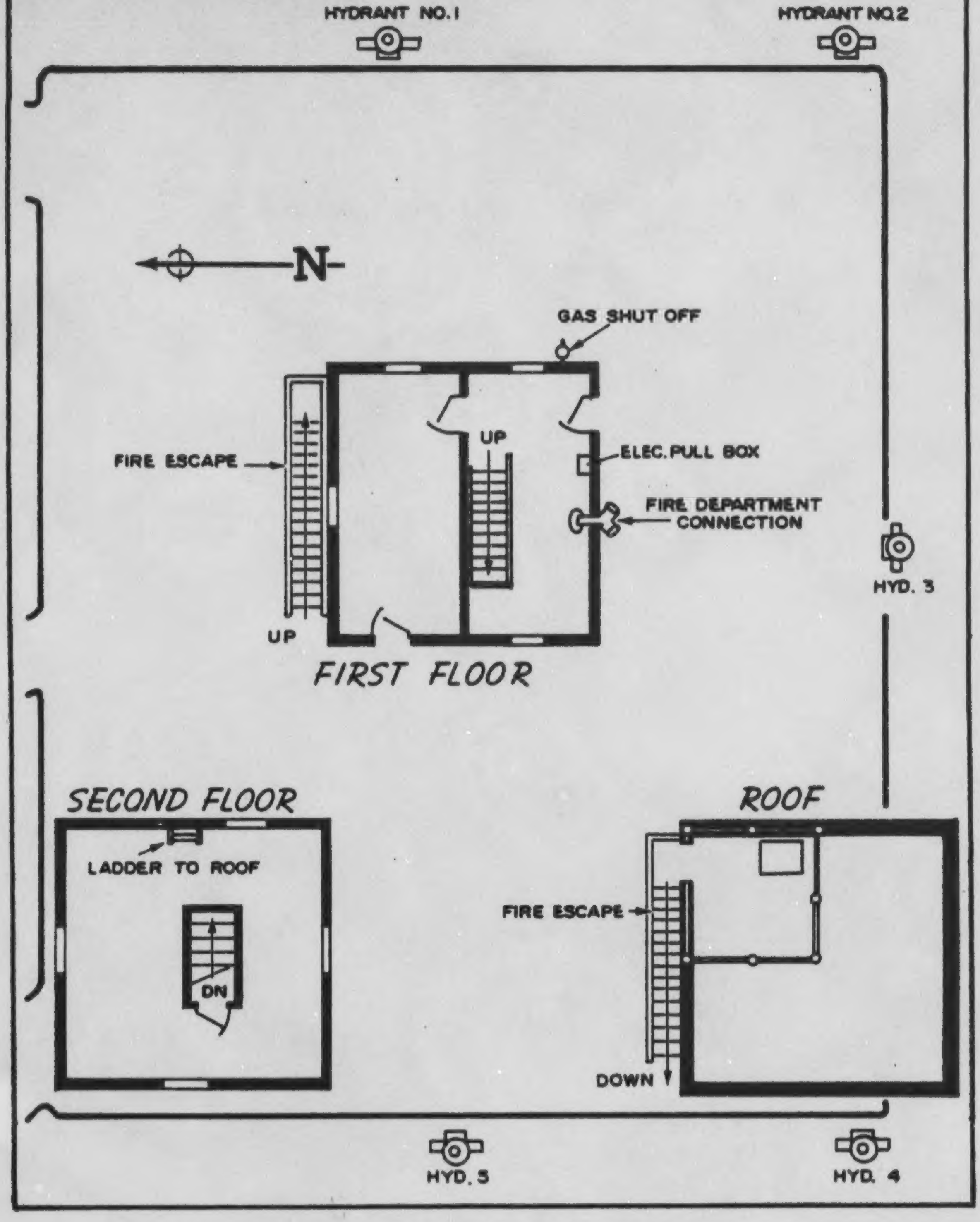

HYDRANT NO.1
HYDRANT NO.2
N
GAS SHUT OFF
FIRE ESCAPE
UP
ELEC. PULL BOX
FIRE DEPARTMENT CONNECTION
HYD. 3
UP
FIRST FLOOR
SECOND FLOOR
LADDER TO ROOF
DN
ROOF
FIRE ESCAPE
DOWN
HYD. 5
HYD. 4

Figure 2. Reverse Side of AF Form 1028.

AUTHENTICATION OF PREPLANNING

Review AF Form 1028 at least annually and update as required. Prefire plans are prepared on AF Form 1028, see figures 1 and 2 for examples.

QUESTIONS

Please write your answers to the following questions on a separate sheet of paper.

1. The purpose of prefire planning is to __________ firefighters in known factors.

2. Prefire plans are used to __________ certain duties.

3. Building prefire plans are carried on the assistant fire chief's vehicle and each __________ pumper.

4. Aircraft prefire plans are developed on each type of __________ aircraft.

5. Prefire plans must be reviewed at least __________.

REFERENCES

1. AFR 92-1, Fire Protection Program.

Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-SG-304

MISCELLANEOUS RESCUE

OBJECTIVES

After completing this study guide and your classroom instruction, you will be able to:

1. Identify procedures for rescuing personnel from miscellaneous areas and disasters.

2. Perform normal and emergency entry into a vehicle.

3. Perform rescue from a vehicle.

INTRODUCTION

Many times you will be faced with rescue situations which do not involve aircraft or buildings; therefore, we have included this section of study material. You may be faced with automobile accidents or a natural disaster at any time. We are the only specialized ground rescue the Air Force has and can be called upon to perform in any given rescue situation.

INFORMATION

You are aware by now that first aid is the most important single part of the rescue operation. Without first aid, many times any other part of the rescue operation is useless. Any time a rescue is required, someone is in need of help. It is your responsibility first to remove the victim to a safe atmosphere, then to give him the aid he needs. Sometimes the victim may not need any assistance other than releasing him from a pinned situation. Other times the victim may be in a burning building or aircraft, may be pinned or trapped, may have severe physical injuries, and a number of other problems that requires numerous actions by the rescueman.

NATURAL DISASTERS

Being in the rescue field may necessitate your presence at the scene of a natural disaster. During a natural disaster (and thereafter) the public will need all the help that is available to them. You will be working under far different conditions than you have ever different conditions than you have ever worked under. You will probably be working for a different boss.

A natural disaster is a disaster caused by nature or the natural elements. This would be floods, tornadoes, hurricanes, etc. In any of these situations, your first concern will be to survive and then help others to survive. After the situation has subsided, you will restore the base to operation (where we are concerned, we make sure all rescue business is taken care of) then we will probably be called upon to assist the local community(s). When you leave the base, you are responsible to the Civil Defense officials in your capacity as a rescueman. They will direct you as to where to start, where the victims will probably be trapped or located, when to terminate your mission, etc. You will be working in the operations jointly with local rescue, police, fire, and other civil servants, in their attempts to rescue entrapped personnel.

AUTOMOBILE ACCIDENTS

Automobile accidents are the most common rescue situations that any rescue team is exposed to. Any number of situations can be associated with an automobile accident including fire, explosion, trapped and pinned victims, severe physical injuries and many more too numerous to mention. Extrication from automobiles requires many hours of training with tools, procedures and emergency care.

Other rescue situations discussed here can arise during natural disaster or in miscellaneous areas.

As you can imagine, if you stay proficient in the art of rescue, you have a full time job.

Extrication From Automobiles

Automobile rescue requires specialized training and special items of equipment which should be acquired. You should have more than a pry axe and K-12 saw and will find that you should have special items such as port-a-powers, come-alongs, and various other tools. Very often the victim of an automobile accident is killed by an attempted rescue instead of the accident. When you are dealing with people's lives you cannot put a price on everything because a tool or piece of equipment can prove priceless to the person being rescued.

Training is also a very important part of automobile rescue. Without training, you will accomplish nothing other than seriously injuring or perhaps even killing the victim. This cannot be tolerated. You have a job to do that cannot be graded by the degree of accuracy with which you perform. You will be graded or judged by the success or failure of the mission (which is to rescue the victim). If the victim dies, even through no fault of your own, there will be those who will blame the rescueman because he is there and is available. If you successfully rescue the victim, you will be praised regardless of the mistakes that you know you made. In some cases you may be officially charged with malpractice or misconduct and rightly so if you did not do the job you are getting paid to do. Remember people's lives are dependent upon you, the rescueman, and that's the most important asset a person has. In some cases, even your own life may be at stake and may be lost if you make the wrong decision or don't know what you are doing.

The general rule that no injured victim should be moved before he is given emergency first aid can be disregarded if his life and well-being are endangered where he is. The victim should be moved out of danger at once if possible.

Normally, extrication is divided into five stages, as follows:

1. Gaining access to the victim.
2. Conducting the primary survey.
3. Disentanglement.
4. Preparation for removal.
5. Removal.

Gaining Access to the Victim

Gaining access to victims usually presents no problem. In the great majority of automobile accidents the victim has either been thrown out in the crash, has removed himself, or has been removed by uninjured passengers or other motorists. The threat of fire is the main reason for hurried and possibly dangerous removal of patients from automobile wrecks. However, a recent survey of 42,000 accidents revealed that vehicles not on fire by the time the police arrive were not likely to catch fire.

Gaining access to the victim depends on the location and position of an automobile, damage to the car and the position of the victim in it. Access may be as simple as opening the door or as difficult as opening a car that is upside down at the bottom of a river or lake. Access might involve forcing open doors, cutting off the roof, breaking out glass, jacking up the car or pulling a steering wheel or seat.

Lifesaving Emergency Care (Primary Survey)

The primary survey is instituted when necessary while the patient is still in the car both during and after access to the victim has been gained. The primary survey consists of:

1. Establishing and maintaining an airway.
2. Giving artificial ventilation.
3. Controlling bleeding.

Cardiopulmonary resuscitation is not listed since it is ineffective when performed on a victim who is in a sitting position or in an automobile. The victim must be lying down on a flat, sturdy surface for cardiopulmonary resuscitation to be effective.

Disentanglement

The importance of disentanglement of the victim from any thing restraining him inside the automobile must be emphasized, even though the primary concern is removal of the victim from the vehicle. Removing or disentangling the vehicle from the victim should be considered if it is the more likely way to prevent further injury. The victim may have been thrown up underneath the dash if he wasn't wearing a safety belt, he may have a part of the steering wheel impaled in his chest if he wasn't wearing the safety harness, or he may be pinned in the automobile or pinned partially outside the vehicle.

Preparation for Removal

Once the automobile parts and other impediments have been disengaged from the victim and other physical restraints in and around the car have been removed, the victim should be prepared for initial movement and subsequent transportation to the ambulance. Such preparation should:

1. Protect the victim from further injury.

2. Facilitate removal.

Fractures should be immobilized where possible, wounds dressed, and the victim "packaged" for lifting and removal.

Removing from Automobile

Removal from the car and transportation to the ambulance may be as simple as assisting the victim to step out of the car into the ambulance or as complicated as removing him on a spine board and then up a brush-covered hillside.

Special Problems

Access, disentanglement, and removal from automobiles present special problems which require special instruction. Major points are presented here in detail.

Methods of gaining access and disentangling automobile parts and debris from around the victim require a great deal of common sense and ingenuity in the use of available methods and tools. While no two automobile crashes are exactly alike, similarities do exist.

Lighting is of utmost importance in many instances. It is impossible to work effectively in the dark or with inadequate lighting where persons injured are in serious danger.

Besides flashlights, each rescue vehicle must have floodlights capable of providing light at some distance from the vehicle.

Gaining Access and Disentanglement

During access and disentanglement, great care must be exercised as it is at this time that the tools are closest to the victim. Heat, noise, and force should be kept to the necessary minimum. Possible injuries the victim may have sustained should be taken into account to avoid making his condition worse. After access is gained and while disentanglement proceeds, efforts to give emergency care may continue as additional body areas become accessible for treatment.

A knowledge of mechanics and a familiarity with the available tools will facilitate access and disentanglement procedures. Prying, either manually or with powered equipment, is the method most frequently used on wrecked cars. Wrecking bars and crowbars will spread metal, open doors, or provide some type of opening into the car. Where manual force is not sufficient, the hydraulic rescue kit with a spreader ram is used. An opening usually must be made, or one already present enlarged, to accommodate the jaws of the spreader. After a jammed door has been opened, two men should be able to rotate it completely out of the way by breaking the door check and, at times, the hinges. If a come-along is available, it should be used to remove the door from the hinges.

One of the difficulties that will be encountered in new cars is the metal safety lock which prevents prying the door open and often necessitates cutting the bolt before the door may be opened. One method used by automobile body mechanics is to cut a half circle around the door handle and turn back the resulting flap of metal, thus gaining access to the lock. (The door knob activates either a push rod or a metal plate, so there is no direct connection from knob to lock to prevent this.) The doorjamb is then struck a heavy blow with a hammer at the lock, which relieves the tension on the bolt and allows the door to be opened.

Release of entrapped victims often involves lifting or pulling the car, while at other times, parts of the car must be cut away. Needless to say, a knowledge of exactly how to cut away a car is important to avoid injury to an entrapped person. Without this knowledge, it might be better not to attempt such a procedure.

If a car is on its side, access through a door or window will allow surveying the victims and giving emergency care, but removing victims through such openings, although possible, is difficult. The top of the automobile may be turned down for removal of patients by cutting through the door posts or the top itself. Door posts may be cut through with a hacksaw, an air chisel, or a metal cutting saw. The air (pneumatic) chisel is much faster than any other feasible method.

The K-12 or Quickie saw is an effective tool for gaining access to the automobile. A disadvantage is the production of sparks, a distinct hazard when gasoline has been spilled. Hosing down the area before operating the saw, or running the blade under a stream of water, will eliminate this hazard. With a power saw, the top of a car may be turned back in less than five minutes. Cuts should be made through the posts instead of the top itself. This is a faster procedure, creates less sparks, and gives more room to attend to persons inside. The width of the opening possible depends upon the automobile and the way you remove the top. Victims of the accident, still inside the car, are treated and covered with an asbestos blanket before cutting operations on the posts begin.

The air chisel is by far the best cutting tool for use in automobile rescue. It is much faster than the K-12, produces virtually no sparks and is exceptionally safe to operate. It uses air pressure (usually 300 psi) for its operation either from a large bottle, such as a bottle from a cascade system, scuba bottle, or self-contained breathing apparatus bottle. A Scott air tank of air is sufficient to remove the top of a car. The pneumatic chisel "digs" its way into the metal of a car top. It is capable of fantastic speed in cutting the top of a car or a corner post.

The PTO winch is of some value to automobile rescue. It is especially useful for areas where wrecker service is not quickly available. Carried outside the vehicle on the front bumper, it takes up no room which might be needed inside. It is useful to pull open car doors, pull away crushed corner posts, and pull jammed seats back from dashboards. Winches are especially useful when the victim is trapped between the seat and the dash or steering wheel.

1. A chain is run around the seat and attached to the winch cable or grapnel.

2. The rescue vehicle has been positioned behind the car.

3. The rear window of the wrecked vehicle is broken out and the cable passed through it.

4. The rescue vehicle has been braced with blocks against the car in front.

5. The winch is slowly and evenly taken in and the seat is torn from its track while a rescueman holds the victim in place to prevent sudden movement.

Preparing For Removal and Removal

Preparation for removal of a victim entails immobilizing all fractures and dressing all wounds in addition to correcting all life-threatening problems. Use of standard splints in confined areas is at times difficult or even impossible, but simple fixation of upper extremities to the victim's trunk and the lower extremities to each other will suffice until initial movement of the victim provides sufficient space for adequate immobilization.

Making the patient into a package for movement as a unit is best accomplished by means of a spine board; the packaging converts difficult situations into easy ones. The boards are, of course, useful in moving victims with spine injuries and they are very helpful in other cases as well.

The spine board should be applied to the victim before any movement if at all possible. If the victim of an automobile accident is unconscious, you automatically assume that he has a spinal injury. If he complains of pain or discomfort, no matter how slight, apply the backboard.

The short spine board is used most frequently for stabilization of the sitting victim; besides being maneuverable, it provides handholds for easier movement. The head is supported and the neck is immobilized by means of a cervical collar or other means. The head is fastened in place by a headboard and chinstrap. The victim is secured to the body portion of the board by two long straps, applied across the chest and around the thighs so that the weight of the body is supported and does not pull down against the straps on the head and chin. He may be lifted out with little risk if the backboard is properly applied.

If the victim is too large for this, he is removed by means of the long board, which can be slid beneath him; sometimes the patient is slid onto the board. It is highly polished, which makes the sliding action possible. Once the patient is on the board, the long straps are used for firm fixation so that he can be moved as necessary.

Scoop stretchers, like the Sarole, Robinson, or Green stretchers, function in a similar manner, but all have the disadvantage that they must be applied from the side of the victim, who thus cannot be slid onto one; nor may the stretcher be slid beneath him from his head to feet, as is possible with the long spine board. One locally designed scoop stretcher uses a removable back (spine) board as the bottom of the scoop, which is an excellent idea.

Ingenuity, common sense, and mechanical knowledge will solve most extrication problems. Part of the training of the rescueman must consist of practice on wrecked cars from junk yards.

In attempting to slip a short spine board behind a victim seated in a car, the rescueman must exercise care and ingenuity to avoid disturbing the victim or having to move him before he is properly immobilized. It is possible to maneuver the board through the door and behind the patient. If the board strikes the top of the low doorway, it may be turned so that either end goes into the car first. It may then be pivoted into an upright position and slipped behind the victim, who has remained undisturbed.

The following is the proper sequence in fixation of a suspected neck injury on a seated person. The cervical collar (or other means of immobilizing the neck) is applied, after which the spine board is positioned behind the victim. The victim's head is fastened to the board with the chin strap and head band. The torso is fixed to the board by the two straps. The straps are passed through the upper handholds, behind the board, out the lower handholds on the opposite side, around the thighs from outside to inside, and finally, under and over the thighs to the chest buckle, staying as close to the groin as possible.

QUESTIONS

Please write your answers to the following questions on a separate sheet of paper.

1. A natural disaster is a disaster caused by __________ or the __________ elements.

2. In any natural disaster your first concern will be to __________.

3. __________ accidents are the most common rescue situations that any rescue team is exposed to.

4. A knowledge of exactly how to cut away a car is important to avoid __________ to an entrapped person.

5. The __________ __________ is by far the best cutting tool for use in automobile rescue.

6. Preparation for removal of a victim entails immobilizing all __________ and __________ all __________ in addition to correcting all life-threatening problems.

REFERENCES

1. IFSTA #201, Fire Service Practices for Volunteer Fire Departments.

Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-SG-305

ALARM ROOM PROCEDURES AND OPERATION

OBJECTIVES

After completing this study guide and classroom instruction, you will be able to:

1. Identify operational procedures of the alarm and communication center.
2. Monitor, receive and record one normal and one emergency message.
3. Alert firefighting personnel and support agencies.
4. Maintain fire station logs.
5. Read and maintain maps, charts and status boards.

You will be able to observe all security precautions and identify locations by grid coordinates.

INTRODUCTION

To simplify the presentation of this subject, "fire alarm center" will be called simply the "alarm center." It is important for you to keep in mind that the alarm center is the "hub" from which all fire department operations revolve. The handling of telephone calls, radio messages, fire alarm transmissions and switchboards are only a portion of the operator's duties. The alarm center usually contains, in addition to the above mentioned electrical equipment, many other aids. Some of these aids are maps (several types), charts, rosters, fire response cards, run cards, prefire plans, and an activity log. Many air bases will have additional needs for equipment and/or aids. The operator which controls the alarm center must possess special qualities and knowledge. Quick, almost automatic, reflexes and a calmness while under strain are the most desirable qualities of an alarm center operator.

INFORMATION

ADMINISTRATIVE TELEPHONE

One of the most common tools and aids in the alarm center is the administrative telephone. There are normally two or more of these phones installed with extension lines to the other fire department offices such as: Fire Chief, Assistant Chief, Tech Services, etc., for "official business" calls. Always answer these telephones by showing proper courtesy and identification, for instance, "Base Fire Department, Brown speaking, sir."

INTERCOMMUNICATION - PA SYSTEM

A combination intercom and public address system control unit is provided in the alarm center. Connected to the control unit in the alarm room center are a series of speaker boxes mounted throughout the fire station. This system enables the alarm center operator to pass on all emergency information of a fire or aircraft crash to all firemen on duty at once or give voiced instructions to any occupied area of the fire station. An example of its use would be to inform the Fire Chief that he has a "business call" on extension line #1 or extension line #2.

"117" EMERGENCY FIRE TELEPHONES

This phone will be used primarily for receiving structural fire emergency calls only. One or more phone lines are reserved at the telephone exchange for the fire alarm center. The number "117" should be widely publicized and displayed throughout the Air Force to familiarize all base personnel with its purpose.

When answering this telephone, you should state, "Chanute AFB Fire Department," and ask the caller, "Are you reporting a fire?" If a fire is being reported, be calm and record all information accurately and quickly. If the call is a mistake or wrong number, the caller should be informed that "117" is an emergency fire phone number. You should then clear the line as quickly as possible. If the caller requests additional information, have them call back on an administrative phone.

RECORDING BOARD

If the caller is reporting a fire, you must be prepared to record the information accurately and quickly. A recording board will be of great assistance to you. It consists of a list of items of the type of emergency information that firemen combating the fire may or in some cases, must need to know. Items of emergency information listed on this board should include, but not be limited to: TIME, LOCATION, INCIDENT, TYPE, LIFE HAZARDS, PERSON CALLING and OTHER.

"CRASH" ALARMS

Two separate systems are used to notify personnel and activities of a possible or actual aerospace vehicle emergency. A "primary" system is used to notify those personnel and activities most directly affected by an aerospace vehicle emergency. This system is controlled and set into operation by the control tower operator. The system includes the CONTROL TOWER, BASE OPERATIONS, HOSPITAL, and the FIRE DEPARTMENT (ALARM CENTER). Sometimes the alarm center operator will receive notification of an emergency by means other than the primary crash alarm. In these cases, you would notify the proper authorities to activate both the primary and secondary crash alarm systems.

The secondary system is set into operation by Base Operations. Its purpose is to act as a followup to the primary and to notify supporting activities of the emergency. Some of the activities connected are the SECURITY POLICE, CIVIL ENGINEER, BASE COMMANDER, EOD (EXPLOSIVE ORDINANCE DISPOSAL), FIRE DEPARTMENT (ALARM CENTER). The number of activities connected are limited to avoid defeating the purpose of the system.

FIRE REPORTING TELEPHONES

This system of telephones provides specially designed, ideally located stations for reporting fires. The phones at these stations are normally connected directly to the fire alarm center. The alarm center operator is informed that one of these phones has been picked up by a light and an audible sound from a switchboard. The operation of the switchboard will vary with design, but the call is handled in the same manner as the "117" telephone call.

STATION ALARM

Alarm bells or other loud signalling devices are used to "alert" personnel in the fire station or stations of an emergency situation. Usually a specifically marked ON-OFF switch is used to activate the devices. The switch is located in the alarm center and controlled by the alarm center operator.

TWO-WAY RADIOS

Two-way radio communication will be provided between the alarm center, auxiliary stations, mobile units, and all portable transceiver radio units. The master control unit is usually kept and maintained in the alarm center. Local policy will govern the agencies using the same frequency that the fire department uses. Usually, the only agency using the fire department frequency is the hospital. The master control unit in the alarm center must be monitored on a 24-hour basis.

When using a two-way radio unit, be sure to: always speak clearly, use a normal tone, never discuss classified information, and never use obscene language. Pronouncing words correctly for radio transmission is very important. Mispronouncing a word may cause a misunderstanding. To be sure you are pronouncing the words correctly, you must study and learn the international phonetic alphabet.

The terminology of radio differs from base to base to a considerable extent. Yet some terms and expressions are universal. Fire department vehicles will all be assigned radio call signs consisting of a code word designating type of unit, followed by numerical sequence identification. The assigned call number will be affixed on all sides and tops of firefighting vehicles.

During all radio transmissions, a standard Air Force communications code will be used as much as possible at all Air Force bases. Other codes may be added to meet requirements of individual bases. All personnel must be trained in the procedures and use of this code.

INSTALLED SYSTEMS ALARM

All installed fire protection systems should be equipped with an alarm unit. The alarm unit may be operated manually or automatically. In most cases, a coded or noncoded signal is sent. The signal is received at the alarm center. The signal may be visual, audible, or both. When the alarm center operator receives such a signal, a chart is consulted to determine the exact location of the fire by building section, building, or area.

DISPATCHING EQUIPMENT

When the alarm is received from any of the already mentioned devices, personnel and equipment must be sent to determine the trouble or combat the fire. Response cards are usually the primary aid of the alarm center operator at this time. The response card will tell the operator the type, number, and from which fire station the fire trucks will respond. As equipment and personnel respond to the emergency, the alarm center operator passes on needed information over the two-way radio system. Because of poor light in a bouncing vehicle, responding crews often have difficulty reading prefire plans. The alarm center operator transmits over the two-way radio information from the prefire plans to assist supervisors in their size-up and firefighting operations. AF Form 1028, "Prefire Plan," is normally on an 8" x 10" card or paper form and is a graphic plan for each major building or group of identical buildings. A prefire plan provides you with a floor plan of the building involved including utility shutoffs and surrounding area information, which assists you in the five basic divisions of firefighting tactics called size-up. The five basic divisions are:

1. Life hazards (rescue of personnel).

2. Protection of exposure (including interior).

3. Confinement.

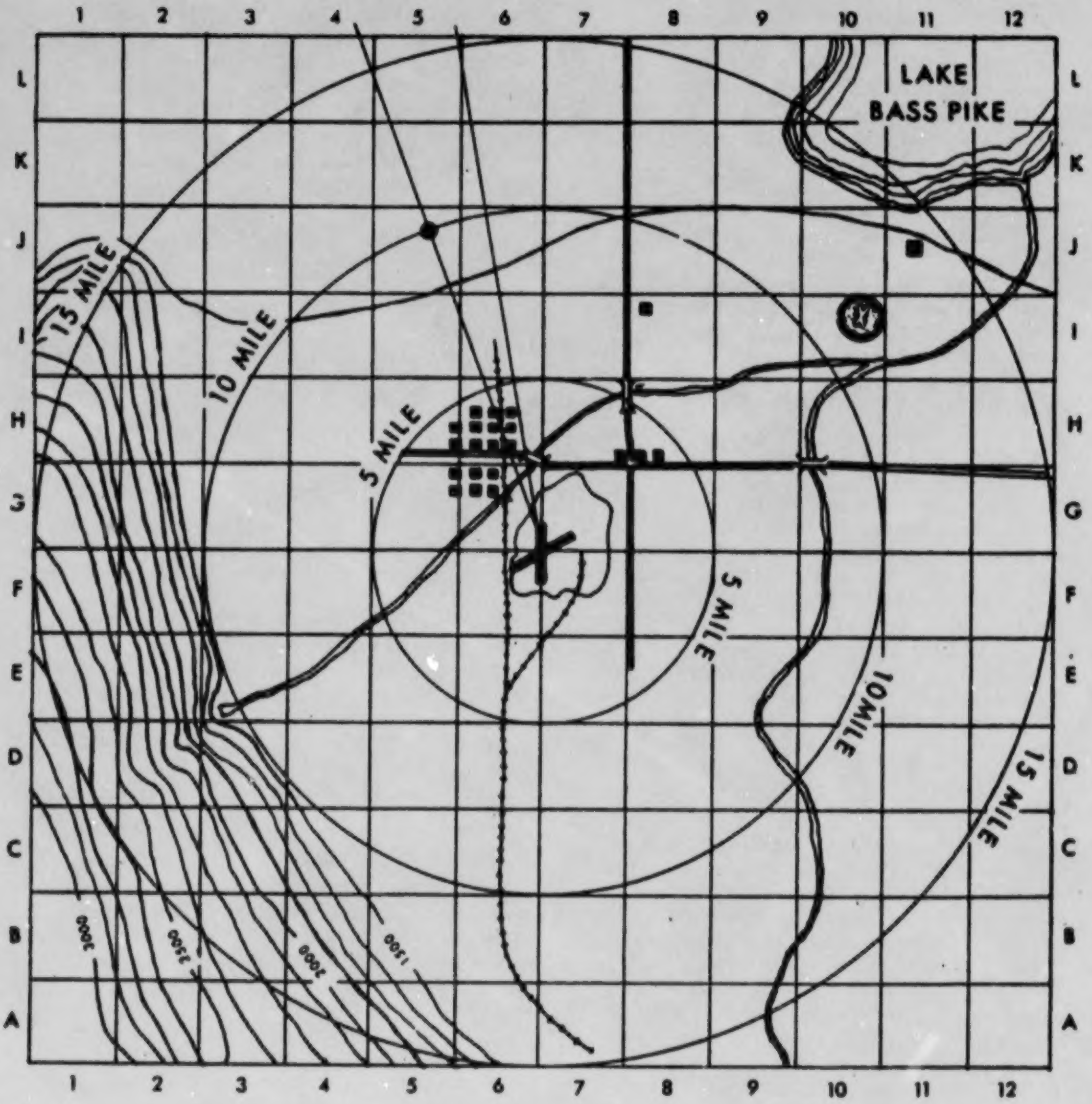
4. Extinguishment.

5. Overhaul.

Many supporting activities are needed at each fire incident. Usually the alarm center operator is equipped with lists of activities to call in the event of a fire or crash. In the event of a major fire, additional personnel and more equipment may be needed. At the request of the Fire Chief, the alarm center operator may be required to recall off-duty firefighters, auxiliary firefighters, and ask for mutual aid assistance from surrounding communities.

DAILY ACTIVITY LOG

The daily activity log is used to record all activity, by time and subject, within a 24-hour period. Some examples of subjects are duty personnel assignments, vehicle movements, and mechanical status, response to fire incidents, emergencies, false alarms, alarms received, visitors, injuries to personnel, etc. The log is prepared in longhand in a bound ledger-type book. Fire incidents and emergencies will be written in red ink. In addition to keeping the daily activity log up-to-date, the alarm center operator maintains a "vehicle status indicator." This indicator may be made of a plastic material with embossed headings. Its purpose is to give a quick, ready reference to the alarm center operator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2500
2000
1500

Figure 3. Grid Map.

of all vehicle locations and condition status.

MAPS

A variety of maps are kept in the alarm center and are used as aids in locating specific points or subjects. These maps are used to show utilities (gas, water, sewage, electrical, etc.) systems, base layout, and surrounding areas. Most of the maps used in the alarm center have grids to assist the user in locating a desired point.

An on-base and off-base grid map will be maintained at the operation office, air traffic control tower, fire department, hospital, and security police office. Normally, the Base Master Plan will be utilized for on-base grid maps with each grid area not exceeding 1,000 feet square and marked for every location of any point within the map area. A 15-mile off-base map will be lined to indicate 1-mile square grid areas and marked for every location of any point within the map area. Compass headings from the base will be lined on the map to facilitate location of crashes by search and rescue aircraft. To establish a standard procedure of reading grid coordinates, maps will be numbered left to right at the bottom and top and lettered bottom to top on each side. Grid maps will be read right and up; therefore, grid coordinates will contain first a number followed by a letter. At base option, a grided area overlay may be prepared for use with each grid map for pinpointing an exact location within a particular grided square area. The overlay will be the same size as a square grided area and contain smaller numbered grids. Copies of the off-base grid map will be kept in all vehicles and aircraft that may respond to an off-base crash. If grid map location was given to you as 10-I, you would read "right" across the bottom of the map to "10" and then "up" to "I." The location 10-I identifies a specific square on the map. In this case, the square where the "X" is shown. See figure 3.

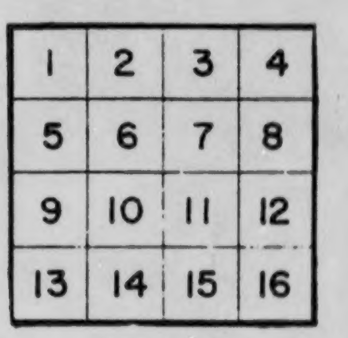

Figure 4. Grid Map Overlay.

Overlay

A transparent overlay, figure 4, is used to pinpoint a location within a grid map square. The outlined area of the overlay should be the same size as one square of the map grid. This little square on the overlay is lined vertically and horizontally and each square should be lettered or numbered. If the overlay were placed on top of square 10-I, it would help to pinpoint a desired location within square 10-I. For example, the "X" could be further located as 10-I-3.

QUESTIONS

Please write your answers to the following questions on a separate sheet of paper.

1. One of the most common tools and aids in the alarm center is the __________ telephone.

2. Extension __________ will be used primarily for receiving structural fire emergency calls only.

3. If a caller is reporting a fire, you must be prepared to record the information __________ and __________.

4. The primary crash system is activated by the __________ __________ operator.

5. __________ __________ or other loud __________ devices are used to alert personnel in the fire station of an emergency.

6. Pronouncing words __________ for radio transmission is very important.

7. In installed alarm systems, a __________ or __________ signal is sent and received in the alarm center.

8. The activity log is used to record all activity, by time and subject, within a __________ hour period.

9. An on- and off-base __________ __________ will be maintained in the alarm center.

10. A transparent __________ is used to pinpoint a location within a grid map square.

REFERENCES

1. AFR 92-1, Fire Protection Program.

Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-SG-306

STRUCTURAL FIREFIGHTING ACCESSORIES

OBJECTIVES

After completing this study guide and your classroom instruction, you will be able to:

1. Tie proper fire service knots and hitches.
2. Tie tools and equipment for hoisting.
3. Inspect and perform operator maintenance on tools and equipment.
4. Carry, position, raise and climb ladders.

INTRODUCTION

In this study guide, we will deal with ropes and ladders as two individual subjects. After each subject has been thoroughly covered, we will combine them into rope and ladder operations while paying particular attention to all safety precautions. We will also inspect and perform operator maintenance on tools and equipment. Although many fires may be fought without a need for ropes and ladders, the Fire Protection Specialist must be proficient in handling ropes and ladders when the need does arise. This one ability may mean the difference between saving or losing a life, or the success or failure of an operation.

INFORMATION

ROPES

Under this topic, you should gain a practical knowledge of typing knots and hitches, and the various uses of each. The rope most commonly used is the safety line. Safety lines should be 3/4" manila hemp (or equivalent) in lengths of 100 feet. The rope ends may be finished with a six-inch loop which simplifies the use of ropes and eliminates the necessity for some knots. At least one such rope should be placed on each piece of structural fire apparatus.

KNOTS AND HITCHES

Most of the rope manufactured in the United States is made from hemp fibers. Some synthetic fiber ropes are manufactured for special purposes and cotton fibers are sometimes braided into ropes which, in some cases, are preferred for life line operation. Manila hemp is imported from the Philippines and makes the strongest of the hemp ropes. Sisal hemp fiber is brought in from the Dutch East Indies and Africa and is about 75 percent as strong as manila hemp fiber.

The manufacturers of common rope twist parallel fibers together in a right-hand direction in making yarn; the yarns are twisted together in a left-hand direction to form strands; and finally, the strands are twisted together in a right-hand direction to make the rope. This method keeps the rope from untwisting and tends to equalize tension throughout the rope.

ELEMENTS OF A KNOT

Knots weaken a rope because the rope is bent in order to form the knot and the outside fibers take most of the strain at the bend. The knot that weakens the rope least is the one requiring the least bending. The bends that a rope undergoes in the formation of a knot or hitch are of three kinds: the bight, the loop, and the round turn. Each of these formations are shown in figure 5. The bight is formed by simply bending the rope, keeping the sides parallel; the loop is made by crossing the sides of a bight; the round turn consists of the further bending of one side of a loop. Knots and hitches are formed by combining these elements

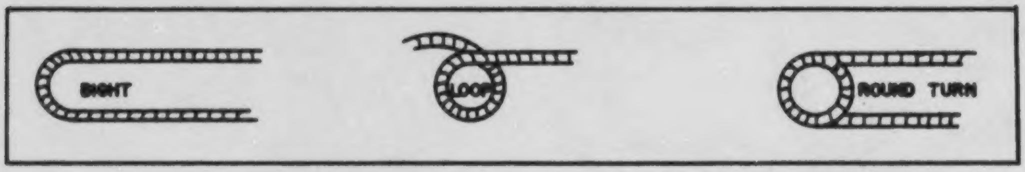

Figure 5. Elements of a Knot.

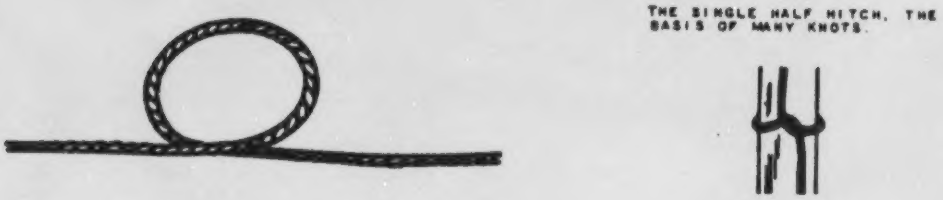

Figure 6. Half Hitch.

in different ways so that the tight part of the rope bears on the free end to hold it in place.

FIRE SERVICE KNOTS AND HITCHES

Fire service rope work in this study guide is limited to the five basic knots and hitches commonly used. Local fire department policies may involve the use of knots other than those discussed here and such policies are considered to be good practices and are encouraged. The methods of tieing these basic knots, as they are shown, are just one good method. If a fireman has learned to tie them another way and is proficient in his work, it is not recommended that he change his techniques or methods. Regardless of the method used, firemen should practice tieing knots until they are proficient. Some departments practice tieing blindfolded. A knot to be of real use must be practiced until it can be tied with as little effort or thinking as is required to tie one's shoes.

Throughout the following descriptions of how knots are tied, the terms "Standing Part" and "Running Part" will be used. In order to completely understand these terms the following definitions are offered.

STANDING PART - That part of the rope that is to be used for work, such as hoisting, pulling, snubbing, and the like.

RUNNING PART - That part of the rope that is to be used in forming the knot as it is being folded together.

A knot is a series of loops and bights forming a secure tie to another object.

A hitch is a loop or loops, and is usually considered as a more temporary form of a knot.

Half Hitch

The half hitch is used as a safety measure and is used in conjunction with other knots and hitches. It is made by forming a loop around an object as shown in figure 6.

CLOVE HITCH

The clove hitch may be formed by several methods and consists essentially of two half hitches. The principle use is to attach the rope to an object like a pole, post or fire hose. The clove may be made either at the end of a rope or in the middle of a rope and, when once properly set, will stand a pull in either direction without slipping. The forming of the clove hitch, as it may be tied in the open, is as follows and is illustrated in figure 7.

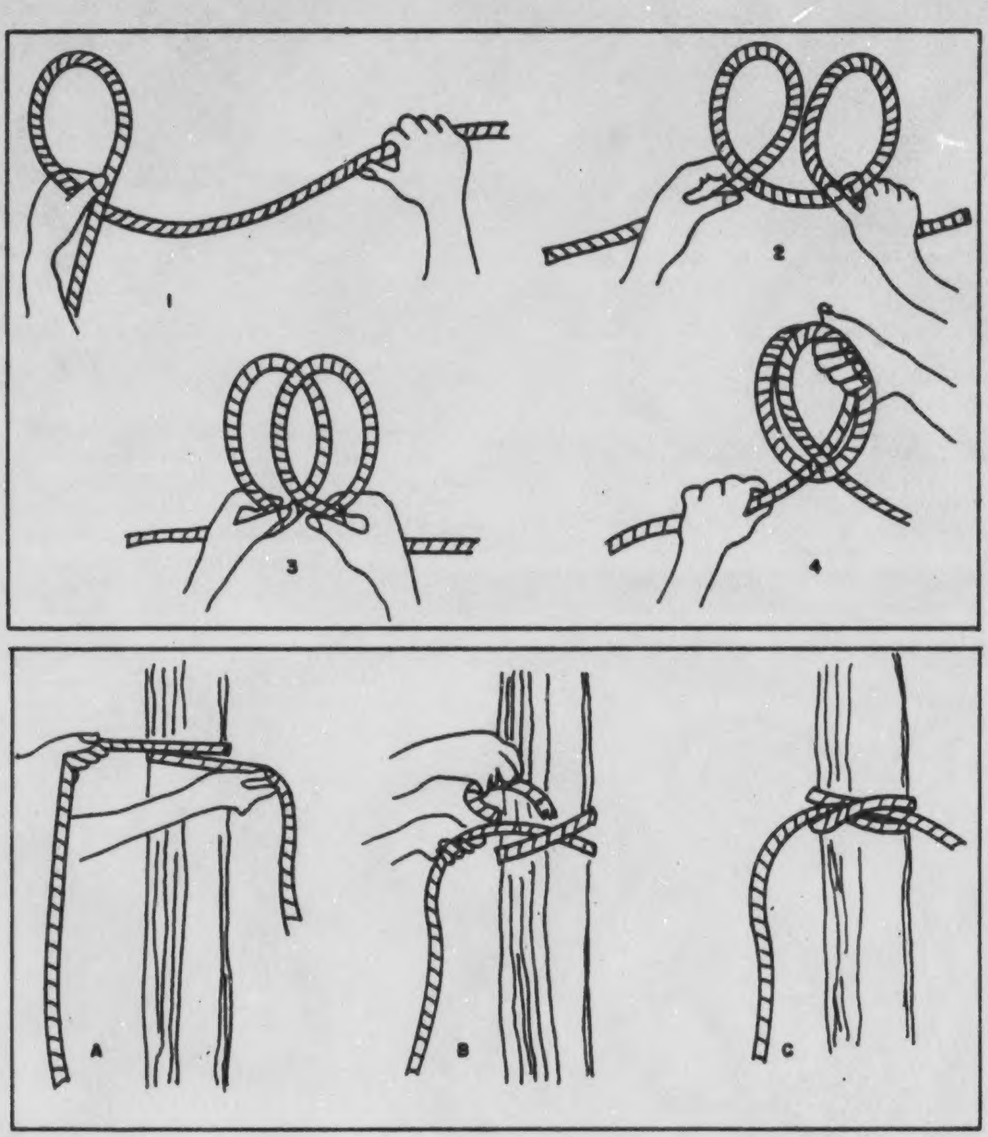

Figure 7. Clove Hitch.

a. Form a loop in the left hand, as is shown in example 1. (This is essentially a half hitch after it is applied to an object.)

b. Form a loop in the right hand in the same manner as the loop was formed in the left hand except for the running part should be on the inside, as shown in example 2. (You now have two half hitches that need to be placed together in the proper manner.)

c. Place the right hand loop on top of the left hand loop, as shown in example 3. (This is the important step in forming the clove hitch.)

d. Hold the two loops together at the top and thus form the clove hitch, as shown in example 4.

The clove hitch, as it may be tied around an object, is illustrated in figure 7.

a. Make one complete loop around the object so as to bring the running part below the standing part, as shown in example A.

b. Cross the running part over the standing part and complete the "round turn" about the object above the first loop as shown in example B.

c. Pass the running part end under the upper wrap just above the cross and by pulling properly, set the hitch. Example C.

Square Knot

The square knot is used to join two ropes of equal size securely. It is accomplished by holding one rope end, in each hand, placing the right end over the left and making a hitch, then place left over right, again making a hitch. The knot is completed by pulling the ends, as shown in figure 8.

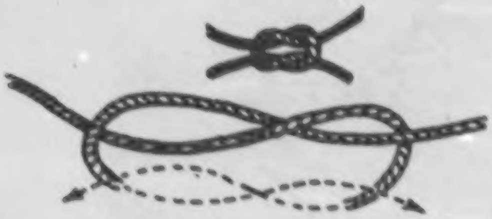

Figure 8. Square Knot.

BECKET BEND

The becket bend is used for joining two ropes. Its adaptability to ropes of unequal size and its unlikeliness to slip when the ropes are wet make it more dependable in fire service rope work. The becket bend is tied as follows and is illustrated in figure 9.

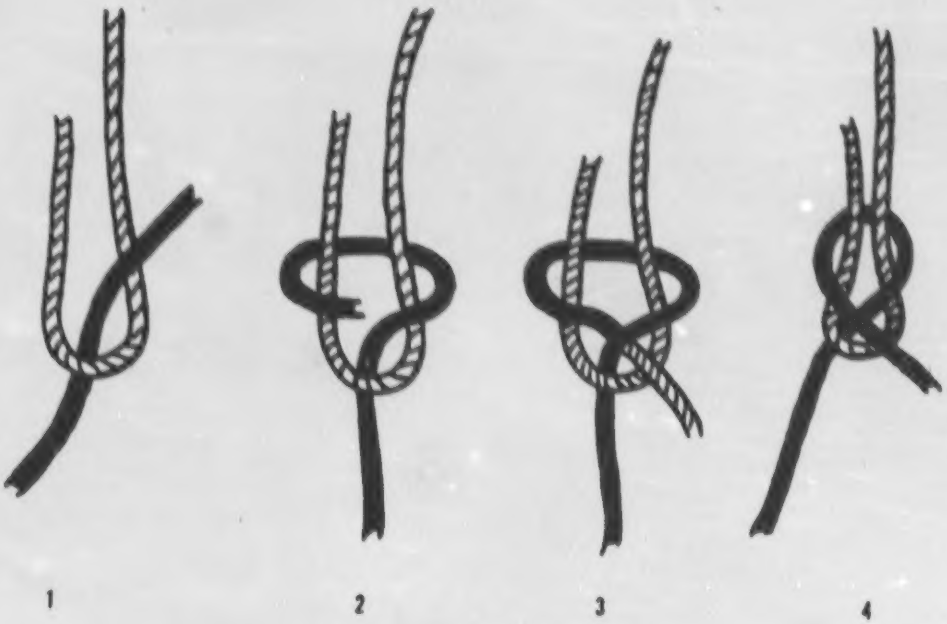

Figure 9. Becket Bend.

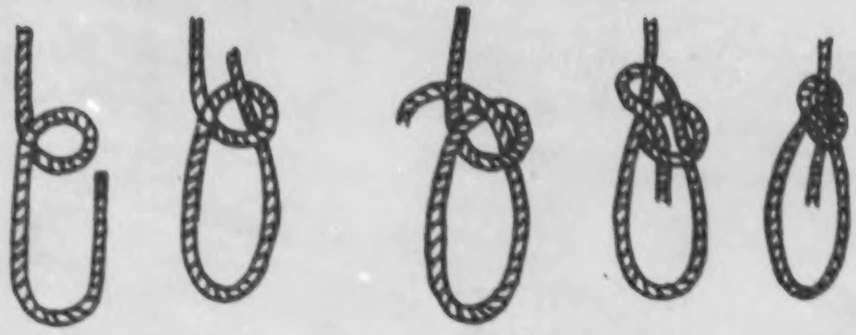

Figure 10. Bowline.

a. Form a bight in one of the ends to be tied and pass the other end through the bight. (This may be done from either side of the bight, depending upon how one is facing the knot, as shown in example 1.)

b. Bring the loose end around both parts of the bight, as shown in example 2.

c. Tuck this end under its own standing part and over the bight standing part, as shown in example 3.

d. Draw the knot tight by holding to each end and standing part, as shown in example 4.

BOWLINE

The bowline is the best knot for forming a secure loop in the end of a rope. The bowline will not slip under strain and may be untied easily. Its use in fire service rope work is extensive, and all firemen should be able to tie the bowline in the open, as well as around an object. The following method is one good way of tieing the bowline, although other methods are just as good. This method is as follows and is illustrated in figure 10.

a. Measure off sufficient rope to form the size of the knot desired and form a loop in the standing part, as shown in example 1.

b. Pass the running part upward through the loop, as shown in example 2.

c. Pass the running part over the top of the loop and under the standing part, as shown in example 3.

d. Bring the end of the running part completely around the standing part and down through the loop, as shown in example 4.

e. Pull the knot snugly into place which forms an "inside" bowline with the running part on the inside of the loop, as shown in example 5.

> Note: The bowline may be tied with the running part outside the loop and is shown as an outside bowline. The outside bowline is just as strong as the inside bowline.

Double Bowline

In situations where natural exits are blocked, a victim must be rescued by some other means of escape. In the case of an unconscious victim, one such method is to lower him from an upper floor by the use of a double bowline rescue knot. The double bowline is tied exactly the same as the bowline just described, except that the rope must first be doubled for the amount of rope to be used in the double bowline. This will form three loops which will not slip or decrease in size with respect to each other. In use, the legs of the victim goes through two loops, while the third loop around the body will prevent the victim from falling out of the leg loops, and the leg loops will take part of the weight from the body loop.

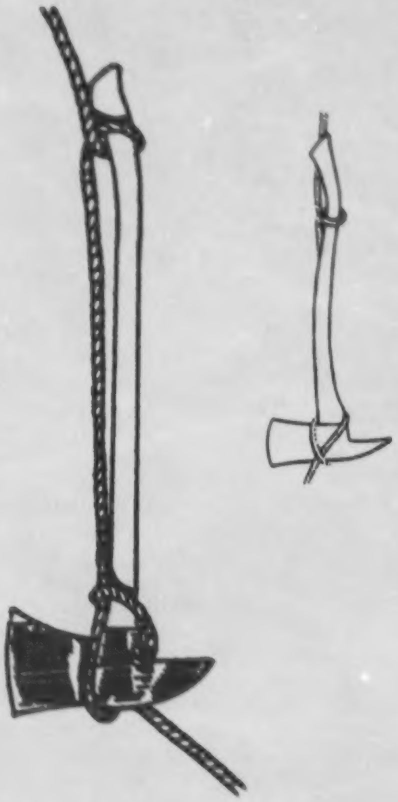

Figure 11. Ax Hitch.

Ax Hitch

Because of their shape and weight, axes are difficult to secure with rope. Care must be exercised to tie a secure hitch. The ax hitch is made by tying a half hitch around the ax handle at the head, passing the line over the head and down the handle, and finishing with a half hitch around the heel of the handle, as in figure 11.

Pole Hoist

The pole hoist is used in raising pike poles, drop bars, door openers, etc., to an upper story of a building. As shown in figure 12, it is accomplished by tying a clove hitch about one end with one or two half hitches near the other end. These tools are usually raised with the heavy end first, see figure 12.

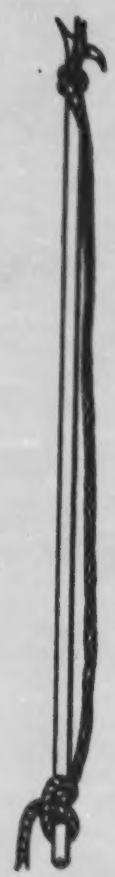

Figure 12. Pole Hoist.

Hose Hoist

The hose hoist is used in raising empty and charged lines to an upper story of a building. It is accomplished by tying a clove hitch and a series of half hitches, as indicated in figure 13.

Extinguisher Hoist

To hoist a fire extinguisher to an upper story of a building, tie a clove hitch around the base of the

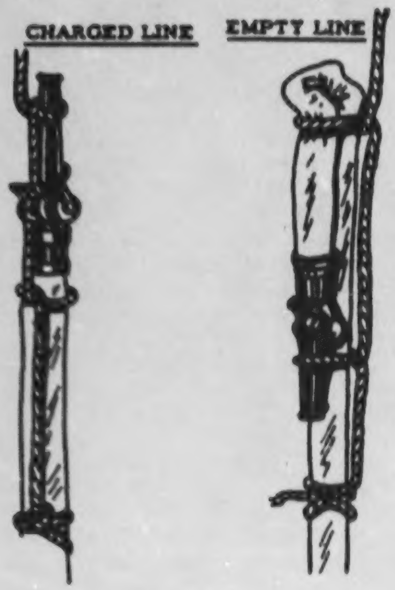

Figure 13. Hose Hoist.

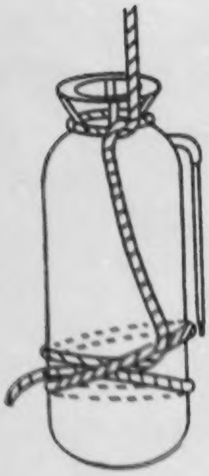

Figure 14. Extinguisher Hoist.

extinguisher and a half hitch around the collar. The bight should be made opposite the extinguisher hose so as to prevent damage to hose and fittings, should the extinguisher hit the building or a projection while being hoisted, see figure 14.

TOOLS AND EQUIPMENT

The value of a firefighter's tools and equipment in an emergency cannot be overemphasized. Proper care and maintenance will assure reliability whenever the situation arises.

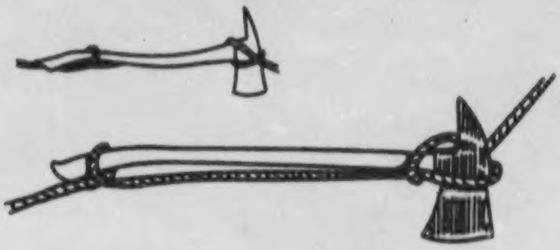

Figure 15. Pick Head Axe.

Pick Head Axe

Care and maintenance consists primarily of keeping head sharp and free from nicks and lightly oiled to prevent rust. Handles are kept tight and free from splinters. Sand smooth and apply a light coat of linseed oil (see figure 15).

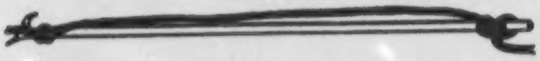

Figure 16. Pike Pole.

Pike Pole

Keep handle smooth and free from cracks and splinters. Inspect head and check for tightness. (See figure 16.)

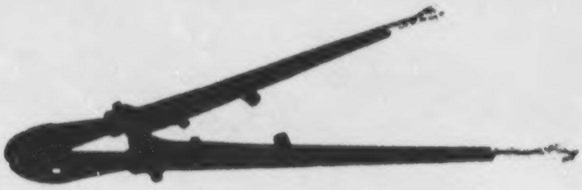

Figure 17. Bolt Cutters.

Bolt Cutters

Keep the cutters clean and dry if painted or apply a light coat of oil. Cutting edges should be free of nicks and lightly oiled. Pivot pins should be oiled for ease of operation and prevention of rust. (See figure 17.)

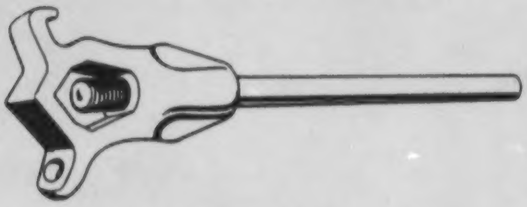

Figure 18. Hydrant Wrench.

Hydrant Wrench

The hydrant wrench should be kept clean and dry. Also, lightly oil the threads for ease of turning and to prevent the formation of rust. (See figure 18.)

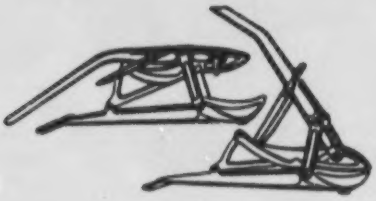

Figure 19. Press Down Hose Clamp.

Hose Clamp

Check handle of the hose clamp for cracks and insure that jaws close sufficiently to cut off flow of water. Oil pivot points to insure smooth operation. (See figure 19.)

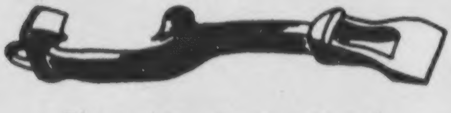

Figure 20. Spanner Wrench.

Spanner Wrench

Check the spanner wrench for rust and cracks and keep clean and painted, if needed. (See figure 20.)

IDENTIFICATION AND USE OF LADDERS

According to Webster's dictionary, "A ladder is made of metal, wood, or rope, commonly consisting of two sidepieces between which a series of bars or rungs are set at a suitable distance, forming a means of ascent or descent." Consequently, when stairs or permanent outside ladders are not available, ladders carried on firefighting apparatus become one of the most important items of fire service equipment for forcible entry. Ladders are emergency equipment to firemen and they are used mostly when every second counts. For these reasons, every fireman must be able to carry, raise, and climb them most efficiently. In order to do this, he must practice such procedures until these operations become as automatic as humanly possible.

The following are common "trade terms" which apply to ladders used in the United States Air Force:

1. Roof ladder - a ladder of one section only.

2. Extension ladder - a ladder built in two or more sections.

3. Main or bed ladder - the lowest section of an extension ladder.

4. Fly ladder or fly - the upper section of an extension ladder.

5. Heel, foot, or butt - the bottom or ground end of a ladder.

6. Top or tip - the top of a ladder.

7. Beam - the principle structural member of a ladder in which the rungs are supported.

8. Rungs - the cross members of the beams used in climbing.

9. Heel plate or spurs - a metal channel reinforcement at the butt end of a ladder.

10. Halyard or fly rope - the rope used in hoisting the fly of an extension ladder.

11. Pawl or dog - a lock used to support the fly of an extension ladder after it has been raised.

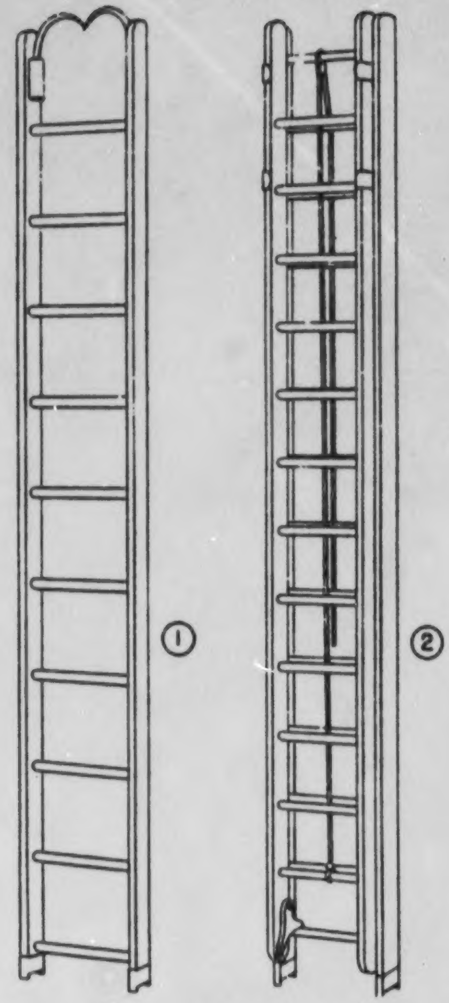

Figure 21. Types of Ladders.

12. Stops - metal blocks used to prevent the fly of an extension ladder from being accidentally extended out of the main ladder.

13. Guides - light metal strips on an extension ladder which guide the fly of an extension ladder while it is being raised or lowered.

Roof Ladder

Number 1 in figure 21 shows the roof ladder. It is a straight ladder adapted for a special purpose. Roof ladders are equipped with special hooks mounted on a movable socket that permits the hooks to fold inward when not in use. Placing the hooks over the roof peaks, sills, walls, or the coping of any opening makes the ladder safe and reliable even if the heel does not rest on a foundation. The roof ladder may also be used as a straight ladder when the hooks are in a stored position. It is valuable in gaining access to peaks of gabled roofs to facilitate removal of roofing materials or to cut holes for ventilation and extinguishment.

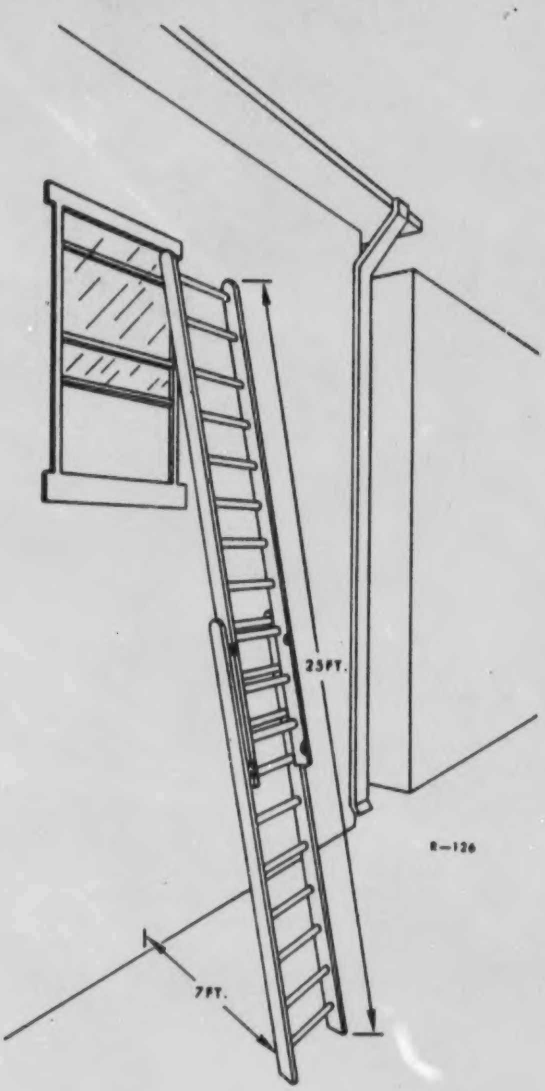

Figure 22. Spacing a Ladder for Proper Angle.

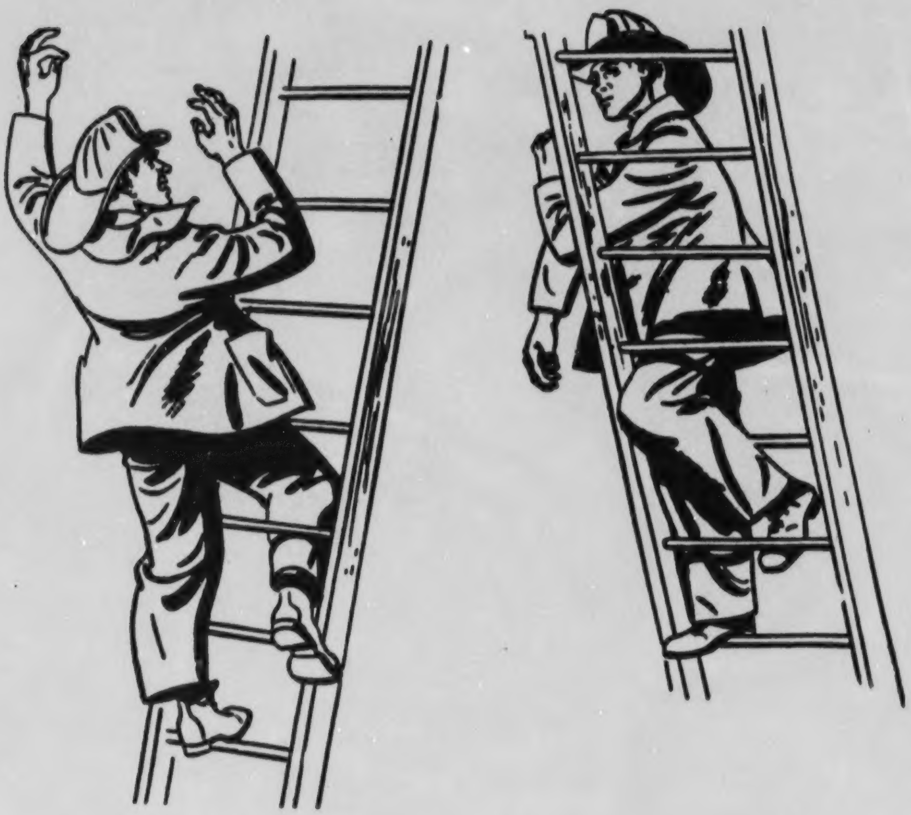

Figure 23. Locking-In on a Ladder.

Extension Ladders

Extension ladders, shown in number 2 in figure 21, consist of a bed ladder and one or more fly ladders. The fly ladders sliding through guides on the upper end of the bed ladder, contain locks (pawls or dogs) which hook over the rungs of the bed ladder. This secures them in a designated position, depending on the desired length of the ladder. The fly is usually raised by means of a halyard (rope) fastened to the lower rung and operating over a pulley on the upper end of the bed. The 35- or 36-foot extension ladder is the type commonly found on pumpers in the USAF.

Proper Climbing Angle

The proper climbing angle for ladders positioned against walls, buildings, etc., prevents ladders from slipping or turning over when the load is shifted, or from vibration caused by activity. One method of finding how far to place the foot of the ladder from the building is to divide the length of the ladder by five and add two. For example, in figure 22, 25 divided by five is five, then adding two we see that the foot of the ladder is placed seven feet from the building.

Proper Climbing Procedures

Ladder climbing is a task similar to ascending a flight of stairs. In climbing a ladder, one hand is always on one of the rungs, unless an article of equipment is being carried up or down the ladder. When carrying an article up or down a ladder, this item should be slid along the beam, if possible, to afford you at least a limited amount of retention at all times. The feet should be placed in the center of each rung to prevent the ladder from wobbling.

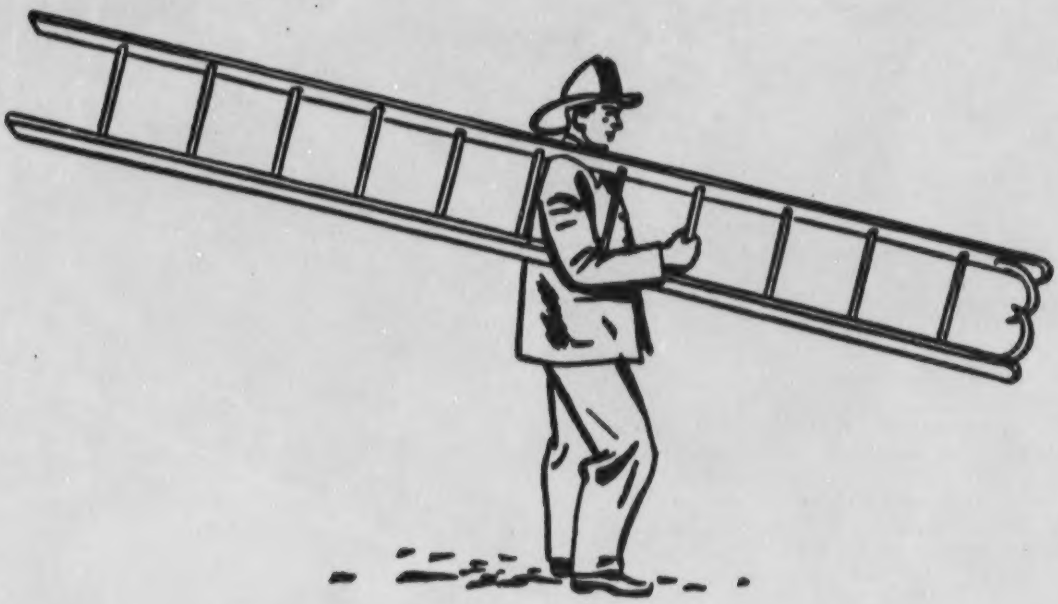

Figure 24. Carrying a Roof Ladder.

For speed and smoothness, the body should be carried in a nearly upright position, with the arms moving outward almost in an arc as the hands are changed from rung to rung. The ball of the foot should be placed on each rung to get complete advantage of the leverage afforded by the ankle.

Lock In on a Ladder

"Locking in" on a ladder is simply the procedure of placing the leg between two rungs and bringing the foot back out between the next lower rung and locking the foot either around the rung or around the beam, as shown in figure 23.

Roof Ladder Carry and Raise

Remove the ladder from the apparatus and pass either arm through the ladder at the middle of its length. The hooks should be carried forward and slightly lowered, as shown in figure 24. For raising, carry the ladder, to the desired location. Place the heel of the ladder against the building, grasp the top rung and raise the ladder to a vertical position while walking toward the foot, using every other rung. After the ladder is upright against the building, grasp the ladder rungs with both hands, about three rungs apart. Lift the ladder off the ground and carry it back to the desired distance from the building.

Carrying the 35- or 36-Foot Extension Ladder - Two-Man Carry

The two-man carry may be used to carry extension ladders. The ladder will be removed from the apparatus and the beam of the ladder will be

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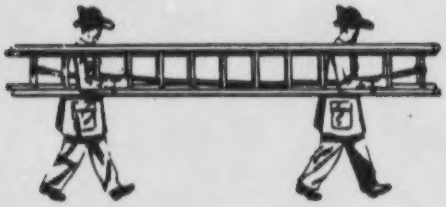

Figure 25. Two Man Ladder Carry.

placed on either the right or left side, depending upon the direction of travel. The arm is passed through the ladder and the hand grasps the beam or the second rung forward. As shown in figure 25, both men will always be on the same side of the ladder while it is being carried. When carrying this ladder in a crowded area the forward man can hold out his free arm to move or warn people in his path and prevent possible serious injury to personnel in this area. If the ladder is lying on the ground it should be lying on the beams of the bed ladder. To pick it up from this position, the two men should face the opposite direction to where the ladder is to be taken. The rung will be grasped with the palm of the hand down. When the ladder is lifted, the two men will turn into the ladder, grasping the rung with their free hands, and place the ladder on their shoulders. When walking, rhythmic steps should be taken to prevent the ladder from bouncing.

> Note: While these ladders can be carried by two men, a minimum of three men are required to raise them.

Carrying the 35- or 36-Foot Extension Ladder - Four-Man Carry

Remove the ladder from the apparatus and place it on the ground with the fly up. Four men take positions, two near each end on opposite sides of the ladder, reach down and grasp a rung with the hand nearest it. Raise the ladder on the shoulder, turning into the ladder, thus the butt of the ladder will be carried toward the target area, as shown in figure 26.

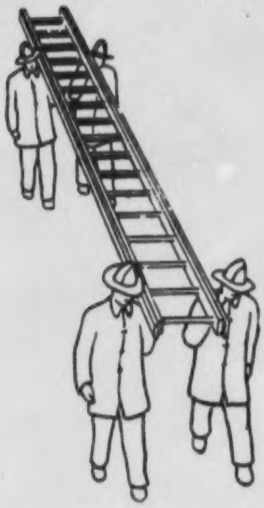

Figure 26. Four Man Ladder Carry.

Raising the 35- or 36-Foot Extension Ladder (Minimum Three Men)

Ladders of this length should be raised utilizing three men, but can be carried by two or four men.

1. The ladder will be removed from the truck or lifted from the ground as recommended in the two or four man carry.

2. It will be carried to a desired location, spacing the ladder before it is raised. (The heel man does the spacing.)

3. The ladder is laid flat with the beams of the bed ladder on the ground.

4. The heel man, No. 1 man, will stand on the heel plate, reach forward grasping the rung with both hands and assist in raising.

5. The number 2 and 3 men will space themselves about one-third distance from the top of the ladder facing the top. They will then reach down with their inside hands, grasp the rung, and raise the ladder, turning their body while raising the ladder, thus facing the heel or butt of the ladder.

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6. They will then walk toward the heel of the ladder hand over hand, using the beams, until the ladder is in the upright position.

Note: All men should watch the top of the ladder.

7. To raise the ladder fly, the No. 1 man will be on the building side and the No. 2 man on the outside to steady the ladder while the No. 3 man raises the fly. The No. 2 man steps back letting the ladder lean slightly away from the building to counteract the strain made by pulling the halyard rope.

8. The man underneath the ladder locks the pawls or dogs by pulling down on the fly rope or halyard from the underside.

9. The ladder is then lowered onto the building by all three men. The man on the outside of the ladder places one foot on the lower rung to steady the ladder.

10. The fly rope should be secured to a rung of the bed ladder as an added safety precaution in the event the pawls or dogs are not locked.

11. To lower the ladder, the procedures are reversed.

Anchoring Ladders

Where it becomes necessary to work off a ladder, it is a good practice to anchor it to the building. The rope hose tool makes a good ladder anchor. It may be used to anchor a ladder to a window sill or to a parapet wall.

QUESTIONS

Please write your answers to the following questions on a separate sheet of paper.

1. Safety lines should be __________ manila help in lengths of __________ feet.

2. A __________ is a series of loops and bights forming a secure tie to another object.

3. The __________ __________ is used to join two ropes of equal size securely.

4. The __________ is the best knot for forming a loop in the end of a rope.

5. The hydrant wrench threads should be __________ for ease of turning.

6. An __________ ladder is built in two or more sections.

7. The __________ or __________ support the fly of an extension ladder after it has been raised.

8. The __________ __________ may also be used as a straight ladder when the hooks are in a stored position.

9. The __________ should be placed in the __________ of each rung to prevent the ladder from wobbling.

10. When carrying a roof ladder, the __________ should be carried forward and slightly lowered.

11. Where it becomes necessary to work off a ladder, it is a good practice to __________ it to the building.

REFERENCES

1. IFSTA #102, Fire Service Ladder Practices.

2. IFSTA #103, Fire Hose Practices.

3. IFSTA #107, Fire Ventilation Practices.

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FIRE PROTECTION HYDRAULICS

OBJECTIVE

After completing this study guide and your classroom instruction, you will be able to identify principles of hydraulics.

INTRODUCTION

Hydraulics is defined as that branch of science which deals with water or other liquids while at rest or in motion. From the length of this definition, it may appear that this is a limited subject. On the contrary, hydraulic engineers spend many years of concentrated effort learning this field. As a fire protection specialist, it is not necessary to become a hydraulic engineer, but the fire protection specialist must know the importance of hydraulics and be able to apply this science at a fire. For example, recently an entire fire protection crew lost their lives because no one computed the weight of the water being put in a building over a two-hour period. The result, the building collapsed and killed the crew. Another example, because of too much nozzle pressure a crew pushed a small fire through the attic of a block long building. Result, the entire building was a complete loss. So, you can see that loss of life and property can result when the basic principles of hydraulics are not properly used and applied.

INFORMATION

EXPLANATION OF TERMS

Knowledge of the following terms is a necessity in the study of hydraulics as used by the Fire Protection Specialist.

Fire Stream

This is the stream of water being discharged from the nozzle tip. A good fire stream will discharge 9/10 of its volume within a 15-inch circle at 50 feet or 3/4 of its volume within a 10-inch circle at 50 feet. Another way of saying this is that a good fire stream will carry a calculated distance and remain to a reasonable extent in a stream without excessive spray. For example, a one-inch nozzle tip with 50 psi of nozzle pressure should have an effective range of about 50 feet, see figure 27.

Friction Loss

Friction results from water rubbing against the interior of a hose. This friction causes a turbulence of the water in the hose and the result is a drop in pressure. This drop in pressure is called friction loss and is measured in psi.

Gallons Per Minute (GPM)

Gallons per minute is the rate of flow measured in gallons coming from an outlet during a given period of time (1 minute).

Operators Guide Plate

A guide plate is a small plate mounted near the pump controls on structural firefighting trucks. This plate is a quick reference and is used to find exact pump pressure when the size of nozzle tip and length of hose laid is known.

Pounds Per Square Inch (PSI)

PSI is the number of pounds of water pressure exerted on each square inch. This water pressure or psi increases at the base of the container as the depth of the water increases. Back pressure, friction loss, nozzle pressure and pump pressure are measured in psi.

Pump Pressure (PP)

The pressure which is required at the pump to produce the desired nozzle

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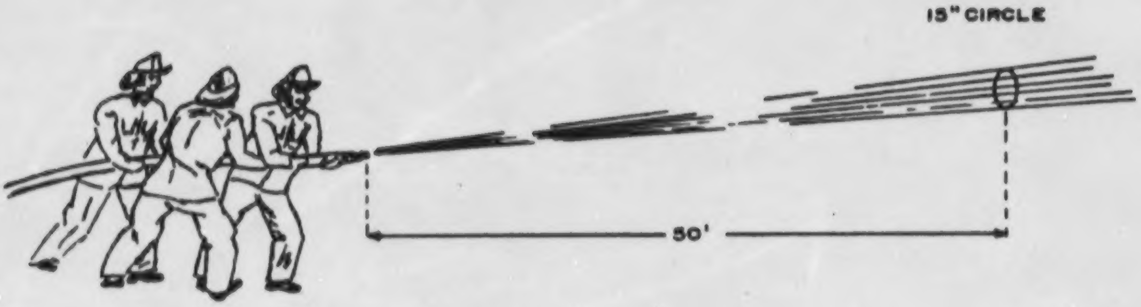

Figure 27. Effective Fire Stream.

pressure at the nozzle. This is obtained by adding friction loss (FL) to the standard nozzle pressure (SNP).

Rule of Thumb

The rule of thumb is a simple method of making a quick approximate calculation of the desired pump pressure. It will vary slightly with the operator's guide plate; however, it is sufficiently close for practical purposes.

Standard Nozzle Pressure

Nozzle pressure is the desired pressure at the nozzle that will give an effective fire stream. The standard nozzle pressure used by the Air Force when using 2-1/2 inch hose with a straight bore nozzle is 50 psi. With a fog nozzle, the standard nozzle pressure is 100 psi.

BASIC PRINCIPLES OF HYDRAULICS

In the study of hydraulics, the Fire Protection Specialist will be concerned only with water. Water is a liquid composed of two parts hydrogen and one part oxygen. One essential characteristic of water to be remembered is that one gallon of water weighs 8.35 pounds (sometimes rounded off to 8.4 pounds). There are two factors that will be discussed which affect the force of water. The first is height. As the height of a column increases, the pressure will increase at the bottom of the column. A column of water 1 inch square at its base and 1 foot high would exert downward .433 psi at the base of the column. If a column of water is two feet high the pressure would be .866 psi at the base of the column. If there was a water tower 100 feet tall with a 12-inch diameter pipe leading to the ground, what psi would be found at the base? To find this psi, the height of the water in the tower is multiplied by .433 psi. The answer to the above question would be 43.3 psi at the base of the pipe. The second factor which affects the force of water is pressure applied to the water by mechanical means. This is normally done by the use of the fire pumps. The Air Force uses both single and multiple-stage, centrifugal type pumps on its firefighting vehicles. The single-stage centrifugal pump consists of a single impeller mounted on a shaft within a pump housing. As the impeller revolves, water moves from the suction pipe to the center of the impeller. It is then picked up by the curved vanes as they revolve. The water is thrown to the outer edge of the impeller by the centrifugal action and passes through the opening in the pump housing. The centrifugal pump is not a positive displacement pump. A sudden shutdown of the discharge line will cause an increase in pressure but it will not necessarily damage the pump or stall the engine. The two-stage centrifugal pump has two impellers that work as individual units. However, they may be combined to produce either the rated volume under limited pressure, or a limited volume under high pressure. This is accomplished by the use of a changeover valve.

Principles of Drafting Water

When fire hydrants are not available to supply water for fire extinguishment, it becomes necessary to obtain it from other sources. This is accomplished by placing the pumper near a lake, river, pool, ditch, or some other water source and pump from a draft. The word "suction" is frequently used when referring to drafting water below the intake of the pump. However, water cannot be pulled upward. Therefore, there must be some other agency present to cause the water to rise. This agency is atmospheric pressure. A priming device is used to create a partial vacuum within the pump and intake hose. This partical vacuum removes part of the atmospheric pressure. The water is then forced up through the intake hose into the pump by the atmospheric pressure on the surface of the water source. The principle can be demonstrated by placing a soda straw in a glass of water. When air is sucked out of the straw, atmospheric pressure on the surface of the water will push the water up the straw. Atmospheric pressure at sea level is 14.7 pounds per square inch and decreases at the rate of one half (.5) pounds per square inch for each 1,000 feet increase in altitude. Theoretically, water can be raised 33.9 feet at sea level but only if a perfect vacuum can be created. Fire pumps cannot create a perfect vacuum. A pump in good condition would be able to raise water about 75 percent of the theoretical height, or about 25 feet at sea level.

HYDRAULIC COMPUTATIONS

It is necessary at times to find out how much water is in a building so the weight can be computed. This additional weight of the water may cause the building to collapse. To find the weight, the nozzle tip size must be known to determine gallons per minute it will discharge. At standard nozzle pressure, the commonly used tip will discharge the following GPM:

Nozzle Size	GPM
1 inch	209
1-1/8 inch	265
1-1/4 inch	326

To find how many gallons of water have been put into a building, multiply the gallons per minute the nozzle in use will deliver by the number of minutes it has been in use. Example: 1 inch nozzle tip (209 gpm) in use for 10 minutes.

Gallons = 209 x 10
Gallons = 2090

To find the weight of the water in the building, multiply total gallons by the weight of one gallon of water. The weight of one gallon of water is 8.35 pounds. Using the example above:

2090	gallons
X8.35	pounds
10450	
6270	
16720	
17451.50	pounds

If you want to know the friction loss for 500 feet of hose having a one inch nozzle tip, here is what to do: Multiply the friction loss by the number of 100 feet lengths. In this case:

Friction Loss (FL) = 10 psi x 5
Friction Loss (FL) = 50 psi

Now try 700 feet of hose having a 1-1/8 inch tip (see chart in this text for FL per 100'). If you get 126 psi, you are right.

FRICTION LOSS AND GPM

Friction loss is determined by the amount of water flowing through an opening. GPM is determined by the amount of pressure and the size of the opening.

CONDITIONS DETERMINING THE SIZE OF NOZZLE TIPS

The first condition is the extent of the fire. A one inch tip is used to keep water damage at a minimum for most ordinary structural fires that have not advanced to the point of becoming an exterior fire. Normally, the one inch tip will provide enough volume and pressure to extinguish an interior fire quickly and efficiently. If the fire has advanced to the point of being exterior fire, greater range and volume is necessary. To obtain this range and

SIZE OF NOZZLE	G.P.M.	NOZZLE PRESSURE IN POUNDS	LENGTH OF 2-1/2 INCH HOSE LAYOUT									
			100	200	300	400	500	600	700	800	900	1000
			REQUIRED PRESSURE AT PUMP									
1"	209	50	62	73	84	95	106	117	128	139	150	160
1-1/8"	265	50	69	86	103	120	137	154	171	188	205	222
1-1/4"	326	50	78	103	128	153	178	203	228	253	278	303

Figure 28. Operator's Guide Plate, 530B, 750A.

volume, the 1-1/8 inch or 1-1/4 inch tip is used. If the size of the nozzle tip increases, the friction loss for that particular nozzle increases. Each of these three nozzle tips has a constant friction loss for each 100 feet length of hose when a standard nozzle pressure is used. In this course, only standard nozzle pressure will be discussed.

The second condition is length of hose. The hose used by the Air Force is the same as that used by other fire departments. This fire hose is flexible, watertight, and durable and is able to carry water under pressure from a source to a fire. All fire hose is issued in sections and fitted with a male threaded coupling at one end and a female threaded coupling at the opposite end. The dependability and life of fire hose depends on the way it is handled, the pressures to which it is subjected, and the care and maintenance it receives. The fire hose that will be discussed in this section comes in 50-foot lengths and is 2-1/2 inches in diameter. If the hose length is 300 feet or less, a 1-1/4 inch nozzle tip is used. If the hose length is 350 to 600 feet, a 1-1/8 inch nozzle tip is used. If 650 feet of hose or more is in use, the one inch tip is used.

To find friction loss utilizing the rule of thumb is very simple. Before we use the rule of thumb, the chart below must be memorized:

Nozzle Tip Size	Friction Loss Per 100 Feet
1 inch	10 psi
1-1/8 inch	18 psi
1-1/4 inch	25 psi

PUMP PRESSURE

When using the rule of thumb to find pump pressure, we add the standard nozzle pressure to the friction loss. Example: 300 feet of hose, 1-1/4 inch nozzle tip.

Pump Pressure (PP) = 25 psi x 3 + 50 psi standard nozzle pressure (SNP)

Pump Pressure (PP) = 75 psi (FL) + 50 psi SNP

Pump Pressure (PP) = 125 psi

To find pump pressure using the operators guide plate, it must first be known what is on the guide plate. Six items appear on the guide plate; size of nozzle tip, gallons per minute, standard nozzle pressure, length of 2-1/2 inch hose, pump pressure and position of changeover valve. The changeover valve controls the flow of water within the pump and will be covered in a later block.

To use the guide plate, we must know the size of the nozzle tip and the length of the hose in use. To find pump pressure, find the nozzle tip size in the lefthand column and then follow across to the right until you reach the block under the column containing the length of hose in use. The number appearing in that block is your pump pressure. See figure 28.

Hose Lines

Hose lines used by Air Force firemen are 1-1/2 inch and 2-1/2 inch hose with nozzles ranging from 5/8 inch through 1-1/4 inch tips. The size and pattern of the stream will depend directly on the nozzle pressure and size. The standard nozzle pressure for the Air Force is 50 psi. The nozzle tip size will depend upon the length of the hose lay. There are three common lengths of hose line layouts used; short lay, medium lay, and long lay. Note the following: 0-6 lengths is considered a short lay; 7-12 lengths is considered a medium lay; 13 lengths or over is considered a long lay. On the basis of the above, rules determining the size nozzle tip will be as follows:

Hose Layout	Hose Diameter	Nozzle Diameter
Short Lay	2-1/2 inch	1-1/4 inch
Medium Lay	2-1/2 inch	1-1/8 inch
Long Lay	2-1/2 inch	1 inch

One and one-half inch hose is rarely used for lays over 300 feet, due to the high friction loss that must be overcome to get the water to the nozzle at the desired pressure. The primary purpose of this hose is to reduce possible water damage and provide for greater maneuverability. Fog patterns are the most desirable streams when using this size hose, as a larger area may be covered by rotating the fog nozzle in a larger circle. It is standard practice in the Air Force fire departments to use two 150-foot lengths of 1-1/2 inch hose connected to a 2-1/2 inch by 1-1/2 inch gated wye which may be supplied by a 2-1/2 inch hose or connected directly to the pumper. The nozzle that is normally used on this type hose will supply 75 gpm at a desired 100 psi nozzle pressure. We must overcome 20 pounds of friction loss for each 100 feet of the 1-1/2 inch hose laid. If you are pumping to two 1-1/2 inch hose lines, connected to a gated wye at the pumper, using 75 gpm nozzles at 100 psi for a nozzle pressure of 100 psi, the friction loss in the 150 feet of 1-1/2 inch hose would be 30 pounds. If the 1-1/2 inch hose is being supplied through 2-1/2 inch hose, we must add six additional pounds of pressure for each 100 feet of 2-1/2 inch hose that is used. Two and one-half inch hose is normally used on exterior fires where maneuverability is not a prime factor in extinguishment. The stream pattern to be selected will depend upon the size and propagation of the fire.

Master Streams

A master stream is a water stream operated at such a heavy volume and pressure it must be controlled by mechanical means. It is the "big gun" of the fire department and is used when hand streams become ineffective because of the large fire area involved. Master streams may be needed on fires in lumber yards, warehouses, hangars, fuel storage areas, and other fires that cover large areas. Before being put into operation, master stream devices must be strategically positioned to accomplish one or more of the following objectives:

1. To place a water curtain between the fire and exposed property.

2. To cover the bulk of the fire with fog or solid streams.

3. To direct fog streams into the heated area above the fire to prevent burning materials from being carried aloft by the updraft caused by the fire.

4. To direct the stream into floors or onto roofs of large buildings.

To produce effective master streams, the generally recognized nozzle pressure is 80 psi for solid streams and 100 psi for fog streams. Because master streams require large volumes of water, the friction loss in the hose will be great. To keep friction loss within acceptable limits, firefighters lay two or more parallel hose lines, brought together at the base of the master stream device. This is called siamesing the lines. Determining the friction loss for siamesed lines is not difficult since the gallons per minute flowing is the determining factor, you must know the approximate flow of the master stream nozzle tip in use. The flows of some master stream nozzle tips at 80 psi nozzle pressure are:

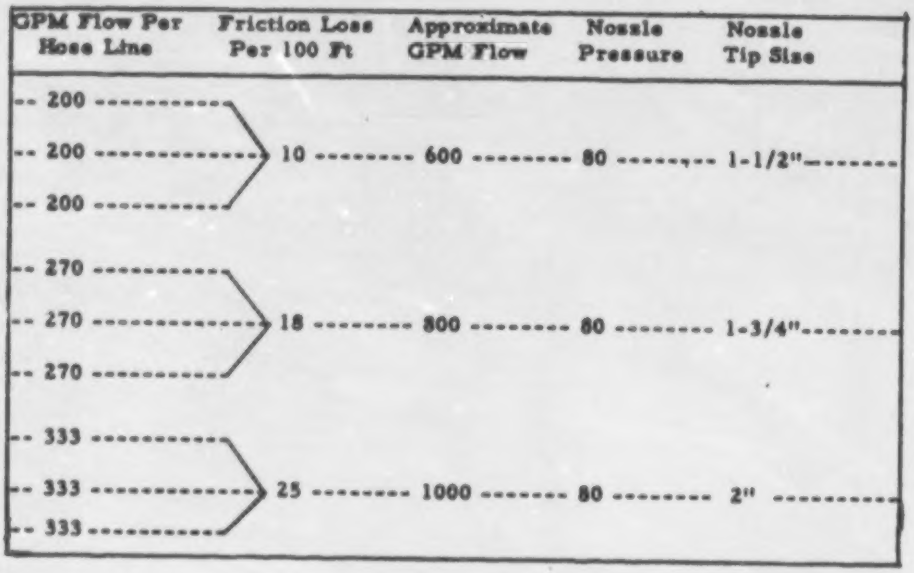
GPM Flow Per Hose Line
Friction Loss Per 100 Ft
Approximate GPM Flow
Nozzle Pressure
Nozzle Tip Size
200
200
200
10
600
80
1-1/2"
270
270
270
18
800
80
1-3/4"
333
333
333
25
1000
80
2"

Figure 29. Master Stream Flows.

Nozzle Size and Pressure	Actual Flow GPM	Flow to Remember
1-1/2" tip at 80 psi	596	600
1-3/4" tip at 80 psi	813	800
2" tip at 80 psi	1063	1000

The method for figuring friction loss is shown in the following example:

A 1-1/2" tip delivering 600 gpm at 80 psi nozzle pressure. Since 600 gpm produces excessive friction loss in one 2-1/2" line, it is necessary to divide the flow through three hose lines. This permits 200 gpm to flow through each line, which is comparable to a 1" tip at 50 psi nozzle pressure. The friction loss, therefore, is the same in each case (10 psi per 100 feet).

Study figure 29 to understand how various flows can be divided into siamesed hose lines to reduce friction loss.

In conclusion, there are two factors which are of prime importance in producing master streams. These factors are:

1. Know your nozzle tip sizes for master solid streams.

2. Know the gpm flow for each size tip at 80 psi.

Siamesing

Siamesing is used to reduce friction loss in long lays when 2-1/2 inch hose is used. Two 2-1/2 inch hose lines are joined together using a siamese connection. To compute the pump pressure, first figure the friction from the siamese to the nozzle tip; then figure friction loss from pump to siamese, take 1/4 of this friction loss and add in friction loss for the single line. Thus, friction loss plus SNP = PP.

QUESTIONS

Please write your answers to the following questions on a separate sheet of paper.

1. The __________ __________ is the pressure required at the pump to reduce standard nozzle pressure.

2. A __________ __________ is used to create a partial vacuum within the pump and intake hose.

3. __________ __________ is determined by the amount of water flowing through an opening.

4. One of the conditions to determine the nozzle tip size is the extent of the __________.

5. Two and one-half inch hose is used on __________ fires where maneuverability is not a prime factor in extinguishment.

REFERENCES

1. IFSTA #105, Fire Stream Practices.

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BIBLIOGRAPHY

As time permits, study the reference materials listed in this bibliography from the Base Library. After studying the materials listed, you will possess a much broader knowledge of the course than would otherwise be possible from normal classroom instruction.

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WORKBOOK 3ABR57130-1-WB-300

Technical Training

Fire Protection Specialist

17-2

BLOCK III
STRUCTURAL FIREFIGHTING EQUIPMENT AND ACCESSORIES

19 August 1975

CHANUTE TECHNICAL TRAINING CENTER (ATC)

This supersedes 3ABR57130-1-WB-300, 20 July 1973.
OPR: TWS
DISTRIBUTION: X
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Designed For ATC Course Use

DO NOT USE ON THE JOB

MODIFICATIONS

Pages 1-3 of this publication has (have) been deleted in adapting this material for inclusion in the "Trial Implementation of a Model System to Provide Military Curriculum Materials for Use in Vocational and Technical Education." Deleted material involves extensive use of military forms, procedures, systems, etc. and was not considered appropriate for use in vocational and technical education.

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MISCELLANEOUS RESCUE

OBJECTIVES

After completing the study guide, classroom instruction, and this workbook, you will be able to:

1. Identify procedures for rescuing personnel from miscellaneous areas and disasters.

2. Perform normal and emergency entry into a vehicle IAW locally established procedures, while strictly adhering to all applicable safety procedures.

3. Perform rescue from a vehicle. Rescue must be in accordance with locally established procedures while observing all applicable safety practices.

EQUIPMENT

	Basis of Issue
Pencil or Pen	1/student
TO 36A12-12-13-1	1/student
A/S32P-10	1/10 students
Salvaged Automobile	1/10 students
Rescue Dummy	1/10 students

PROCEDURE

As the instructor covers the information on the subject of miscellaneous rescue, answer questions 1 through 5 in the classroom. After completing the subject, the class will go to the hangar floor. Using a salvaged automobile, perform normal and emergency entry into the automobile. Using a rescue dummy, perform rescue from the salvaged automobile.

QUESTIONS

1. List the first two procedures when rescuing personnel from miscellaneous areas and disasters.

   a.

   b.

2. Name four types of natural disasters.

   a.

   b.

   c.

   d.

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3. ________________ are used for normal entry into an automobile.

4. Name the three parts of the primary survey.

   a.

   b.

   c.

5. In preparation for removal of a victim, we _____________ all fractures and _______________ all wounds.

Normal Entry: Open door.

Emergency Entry:
1. Force door open using the pry axe.
2. Simulate removing the windshield.
3. Simulate breaking the rear glass.

Perform Rescue:
1. Simulate giving first aid to victim.
2. Working in pairs, remove dummy from vehicle using the most practical means to avoid further injury.

Fire Protection Branch
Chanute AFB, Illinois

ALARM ROOM PROCEDURES AND OPERATION

OBJECTIVES

After completing the study guide, classroom instruction, and this workbook, you will be able to:

1. Identify operational procedures of the alarm and communication center.

2. Monitor, receive, and record one normal and one emergency message. Proper communication procedures must be utilized in accordance with locally established policies and all messages must be correctly recorded in less than three minutes.

3. Alert firefighting personnel and support agencies, dispatch equipment, inform personnel of location and nature of emergencies and provide pertinent information on emergencies as required. Proper communication procedures must be utilized in accordance with locally established policies and all actions must be completed in less than two minutes.

4. Maintain fire station logs. Information must be logged with minimum instructor assistance in accordance with locally established policies.

5. Read and maintain maps, charts, and status boards in accordance with locally established policies. All tasks must be accomplished in less than five minutes.

EQUIPMENT

	Basis of Issue
Pencil or Pen	1/student
Fire Department Communications Center	1/5 students

PROCEDURE

As the instructor covers the information on alarm room procedures and operation, answer questions 1 through 5 in the classroom. After completing the subject, you will demonstrate the operation of the alarm center console.

QUESTIONS

1. Who is responsible for all functions of the alarm center?

2. The _______________ telephone is used for normal administrative business.

3. Where are fire reporting telephones located?

4. In what type of areas are automatic alarm systems located?

5. What is the primary purpose of Air Force fire department grid maps?

Proper communication procedures will be utilized when receiving a normal or emergency message. These procedures are:

1. Remain calm.
2. Speak in a clear, distinct voice.
3. Take charge of the conversation.
4. Insure all information is recorded correctly.
5. Use "10" code and phonetic alphabet.
6. Do not discuss classified information.

An example of a normal and emergency message is given below:

Normal: This is Colonel Wall, I would like to see the Fire Chief at 1300 today.

Emergency: I have a fire in my kitchen at 1304 Circle Drive.

As you work at the console, use the following as your log book to record the information received.

OUT	IN	REMARKS

Figure 4. Log Book Page.

Using the following chart and given a code by your instructor, locate the correct building.

CODE	BUILDING
1-1-1	432
1-1-2	466
1-1-3	475
1-2-1	1847 - NORTH WING
1-2-2	1847 - EAST WING
2-2-1	1847 - BASEMENT
2-2-2	2073
2-1-3	P-3
2-3-3	P-16
3-1-1	P-23
3-1-2	2431

Figure 5. Code Chart.

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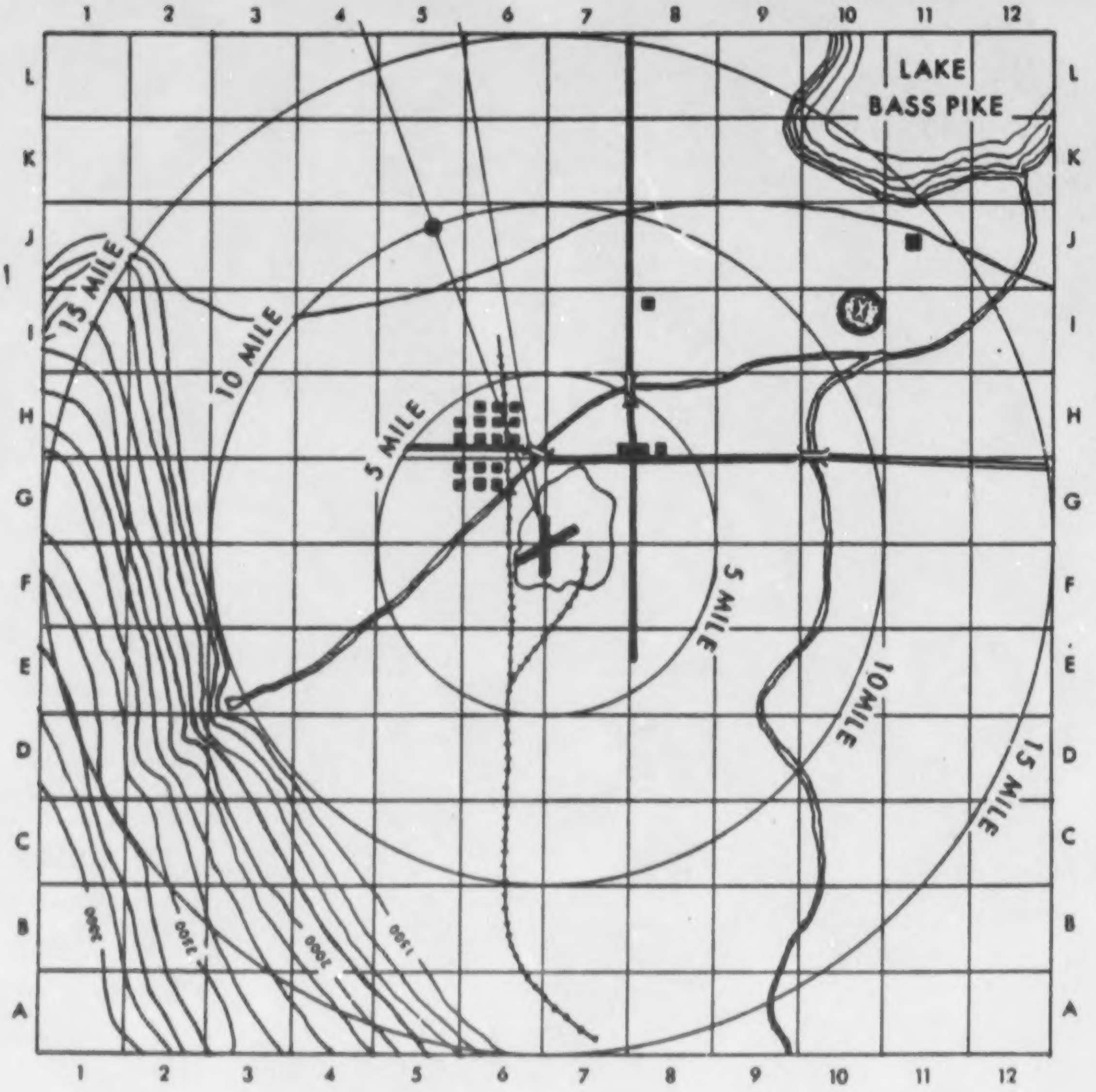
Using the following map and necessary information given by your instructor, read map to find location of an off-base emergency.



1
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12
L
K
J
I
H
G
F
E
D
C
B
A
LAKE
BASS PIKE
15 MILE
10 MILE
5 MILE
5 MILE
10MILE
15 MILE
2500
2500
2000
1500

Figure 6. Grid Map.

Using the following status board and necessary information given by your instructor, indicate status of vehicles.

VEHICLE STATUS BOARD

Vehicle		In Service	Out of Service	Remarks
P-10	09			
530B	52			
530B	92			
530B	95			
530B	14			
750A	26			
750A	95			
750A	97			
P-8	1			
P-8	49			
P-12	76			
P-12	77			

Figure 7. Vehicle Status Board.

Fire Protection Branch
Chanute AFB, Illinois

3ABR57130-1-WB-306

STRUCTURAL FIREFIGHTING ACCESSORIES

OBJECTIVES

After completing the study guide, classroom instruction, and this workbook, you will be able to:

1. Tie four types of knots and three types of hitches in accordance with the WB procedures with minimum instructor assistance.

2. Use ropes to tie tools and equipment for hoisting. Knots will be tied in accordance with the WB procedures with minimum instructor assistance.

3. Inspect and perform operator maintenance on tools and equipment. Procedures listed in the WB must be followed with minimum instructor assistance.

4. Remove, carry, position, raise and climb ladders. All procedures in the WB must be strictly adhered to while observing all applicable safety procedures.

EQUIPMENT

	Basis of Issue
Pencil or Pen	1/student
Structural Firefighting Vehicle and Mounted Equipment	1/5 students
Length of Rope, 3/4 Inch Diameter	1/student
2 1/2 Gallon Fire Extinguisher	1/5 students
Fire Hose, 2 1/2 Inch X 50 Feet	1/5 students
Roof Ladder	1/5 students
Extension Ladder	1/5 students
Axe	1/5 students
Pike Pole	1/5 students
2 1/2 Inch Nozzle	1/5 students

PROCEDURE

After the instructor covers the information on structural firefighting accessories, you will be given a piece of rope and will tie the knots and hitches covered. The class will then go to the hangar floor and tie ropes to tools and equipment for hoisting, inspect and perform operator maintenance on tools and equipment, and demonstrate the use of ladders. After returning to the classroom, identify the illustrations given at the end of this subject.

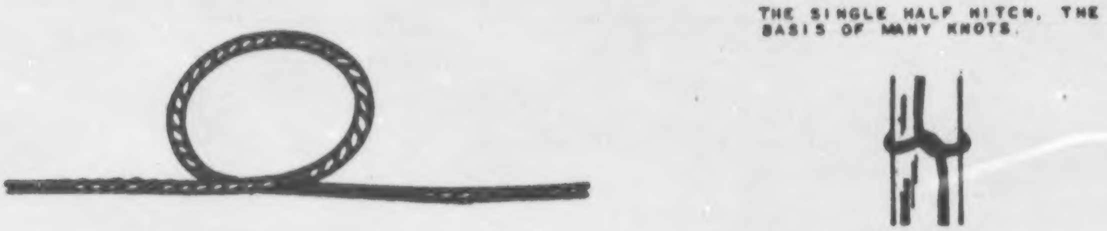

THE SINGLE HALF HITCH, THE BASIS OF MANY KNOTS.

Figure 8. Half Hitch.

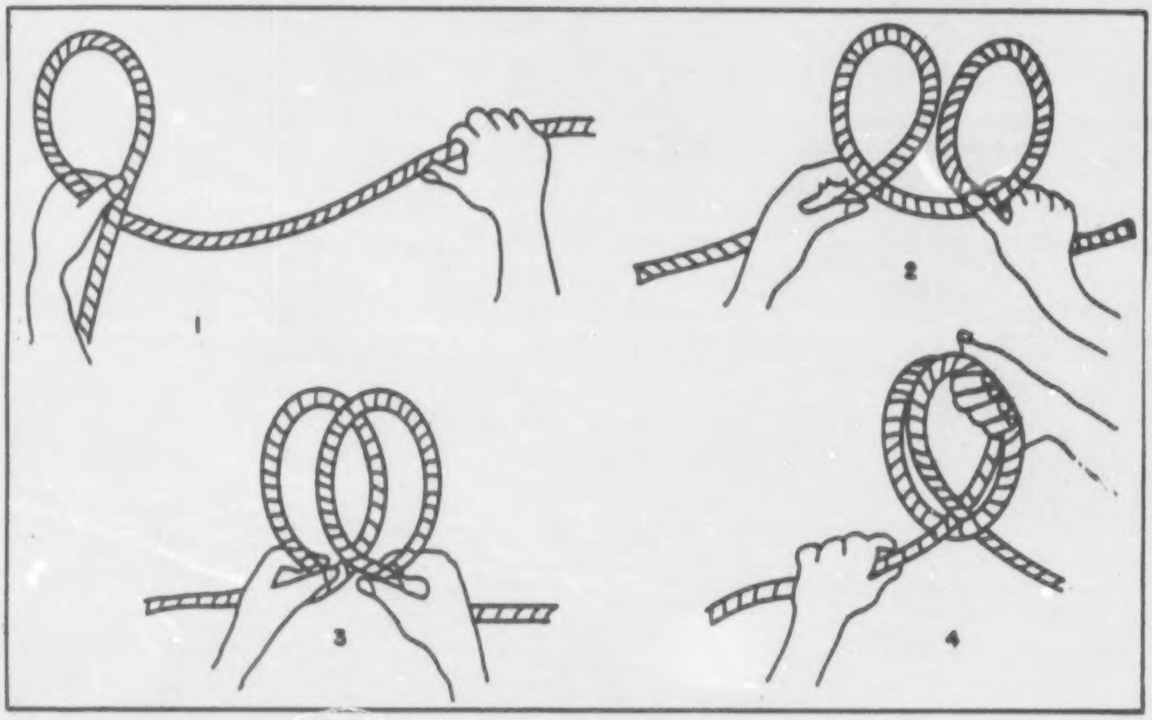


Figure 9. Four Steps to Tying the Clove Hitch.

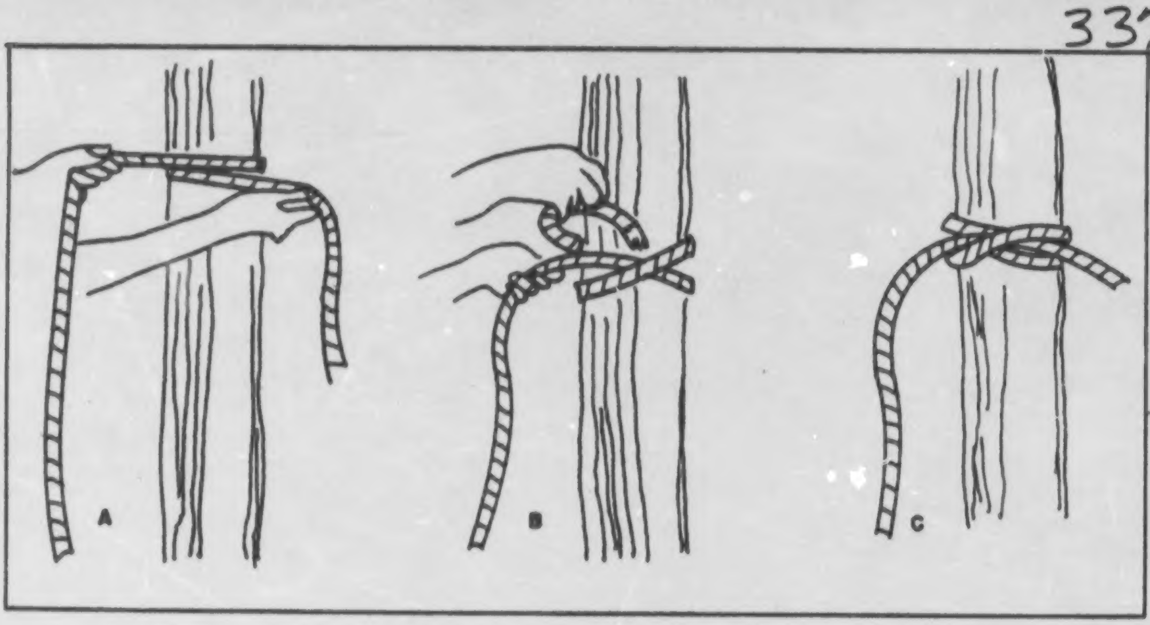


Figure 10. Clove Hitch Tied Around An Object.

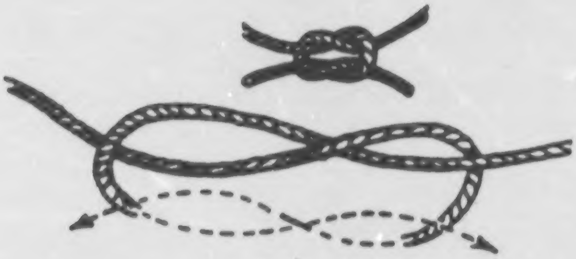


Figure 11. Square Knot.

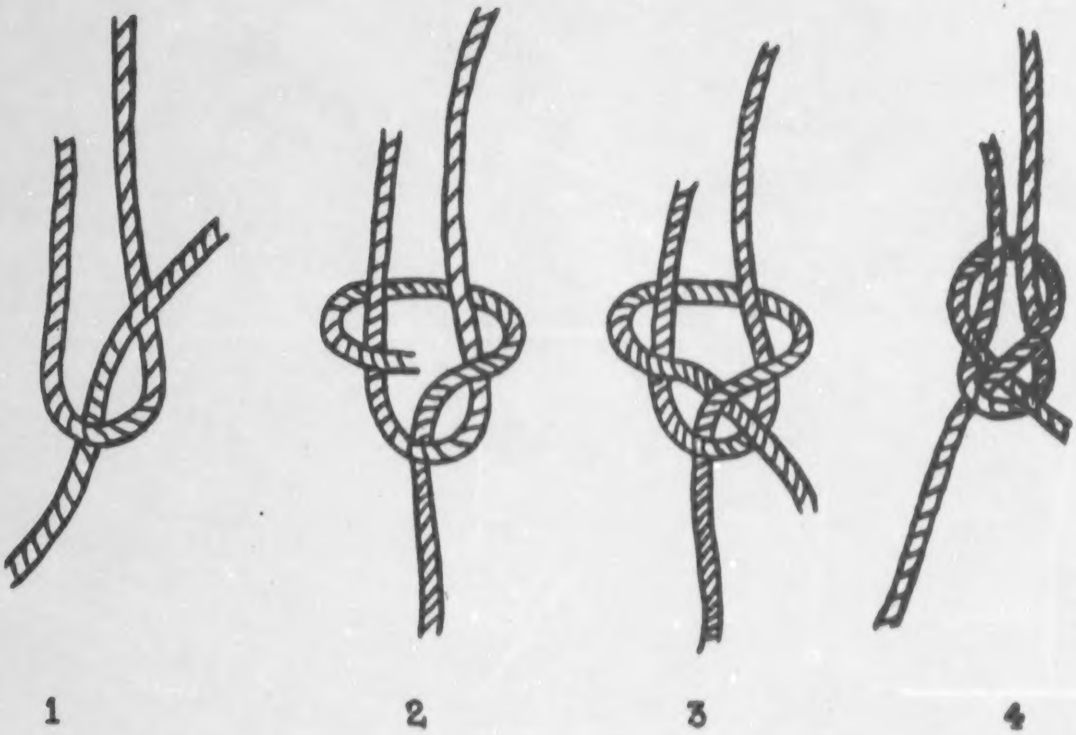


Figure 12. Four Steps to Tie the Becket Bend.

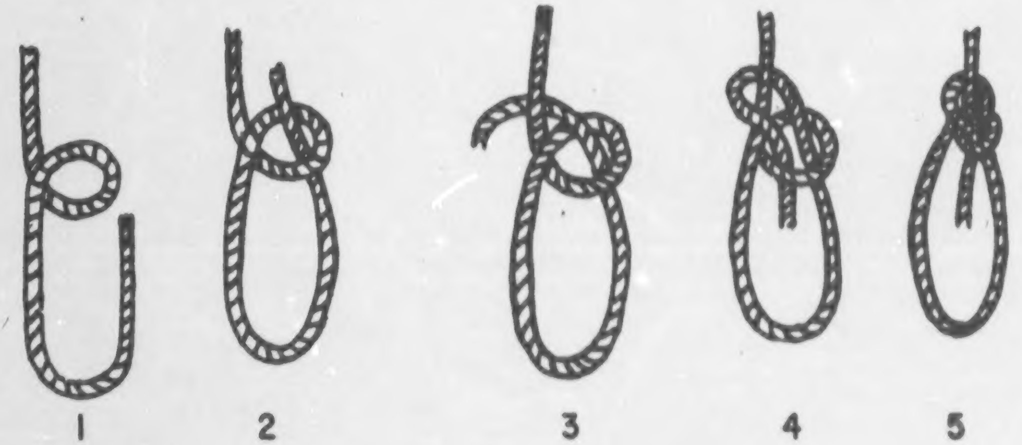


Figure 13. Five Steps to Tie the Bowline.

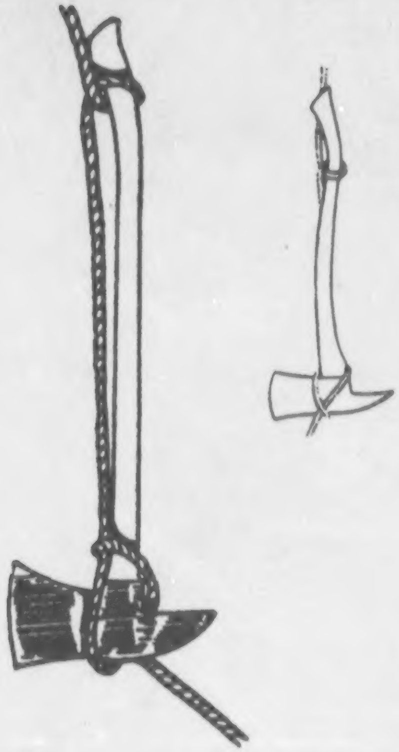


Figure 14. Ax Hitch.

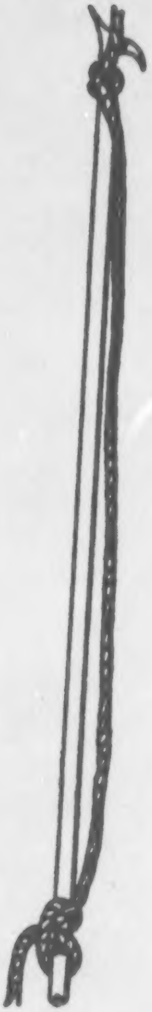


Figure 15. Pole Hoist.

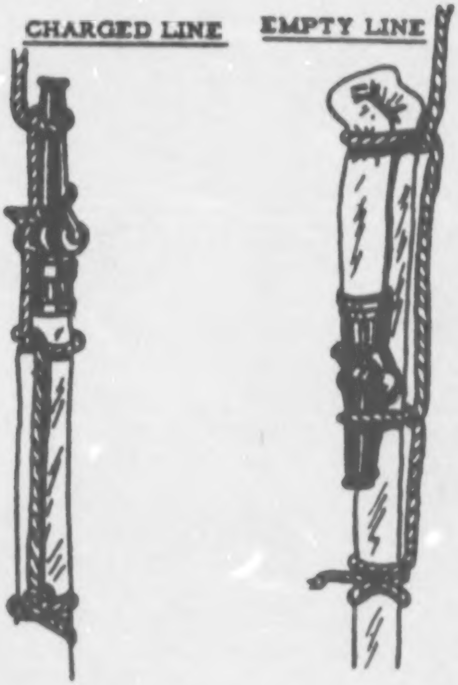

CHARGED LINE
EMPTY LINE

Figure 16. Hose Hoist.

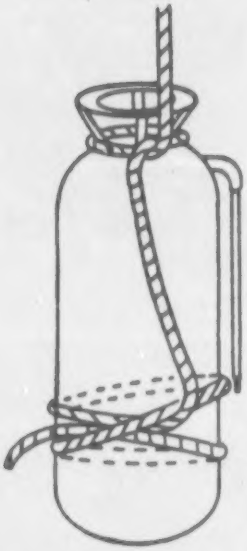


Figure 17. Extinguisher Hoist.

Procedures for hoisting the roof ladder.

1. Tie a bowline that's large enough to place over both beams.

2. Place the bowline about one third of the length of the ladder from the tip through the fourth and fifth rungs from the underneath side.

3. Pull the bowline through the rungs and extend it to the tip of the ladder.

4. Place the bowline over the tip of the ladder and pull on the standing part of the rope.

5. Complete ladder hoist by removing any slack out of the rope and placing a half hitch over the two folded hooks at the tip of the ladder.

Inspection and operator maintenance of tools and mounted equipment.

1. Pick head axe
   a. Check head for nicks.
   b. Check handle for cracks, rot, and splinters.
   c. Examine head for security.
   d. Apply light coat of oil to head.
   e. Sand handle smooth and apply light coat of linseed oil.
2. Pike pole
   a. Check hook for tightness.
   b. Examine handle for cracks, rot, and splinters.
   c. Sand handle smooth and apply light coat of linseed oil.
3. Bolt cutters
   a. Examine jaws for nicks.
   b. Check for ease of operation.
   c. Lubricate hinge pin if needed.
4. Hydrant wrench
   a. Check for ease of operation.
   b. Apply light coat of oil to threads.

5. Hose clamp
    a. Examine for bent handle and worn teeth.
    b. Remove rust and repaint.
6. Extension ladder
    a. Check halyard for fraying.
    b. Examine pawls for free operation.
    c. Check for broken stops.
    d. Inspect all movable parts.
7. Roof ladder
    a. Check rungs and beams for damage or bends.
    b. Examine hooks for smooth operation.

Procedures for carrying the roof ladder.

1. Remove ladder from apparatus.
2. Pass either arm through the ladder at the middle of its length.
3. Carry ladder with hooks forward and slightly lowered.

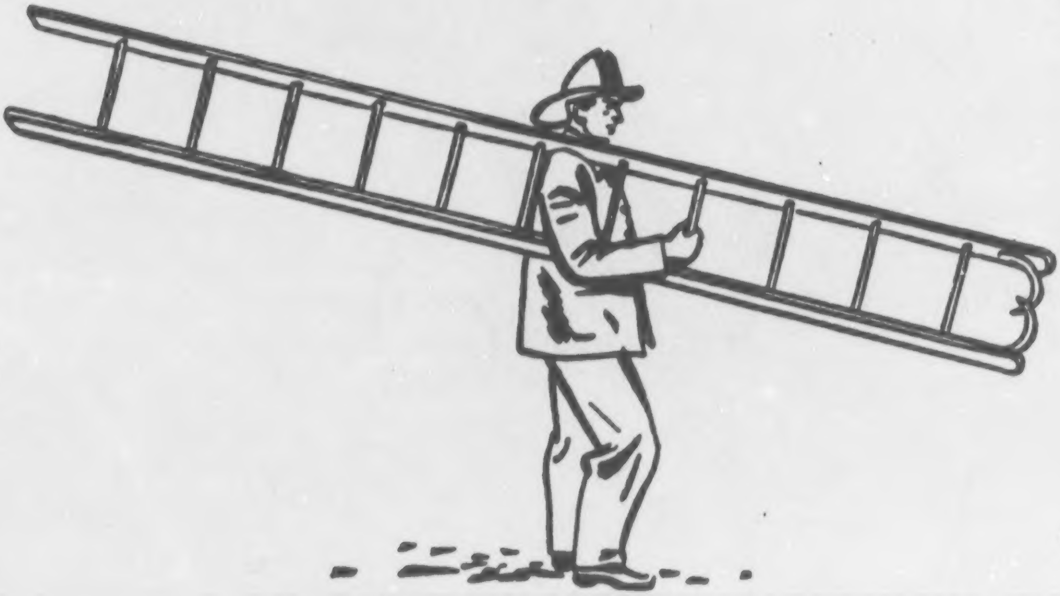


Figure 18. Carrying a Roof Ladder.

Procedures for raising the roof ladder.

1. Carry ladder to the desired location.

2. Place heel of the ladder against the building.

3. Grasp the top rung.

4. Raise the ladder to a vertical position while walking toward the foot, using every other rung.

5. After ladder is upright against the building, grasp the second and fifth rungs.

6. Lift the ladder off the ground and carry it back to the desired distance from the building.

Procedures for carrying the extension ladder - two man carry.

1. Remove ladder from apparatus and place on the beam.

2. Face opposite direction of travel.

3. Lift ladder at each end by the beam, turning in the direction of travel. Pass free arm through ladder, grasping the second rung forward, allowing the beam to rest on the shoulder.

Note: The butt should be carried forward.

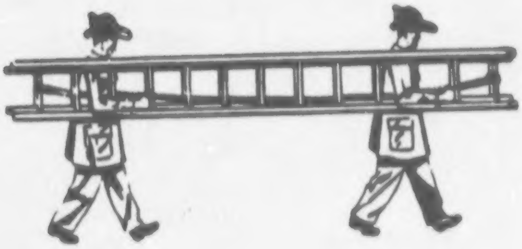


Figure 19. Two Man Ladder Carry.

Procedures for carrying the extension ladder - four man carry.

1. Remove ladder from apparatus and place on the ground with fly up and butt forward.

2. Each man takes his position at each end and on opposite sides facing opposite the direction of travel.

3. Reach down and grab a rung with the hand nearest it.

4. Raise the ladder turning into it, facing the direction of travel.

Note: The butt should be carried forward.

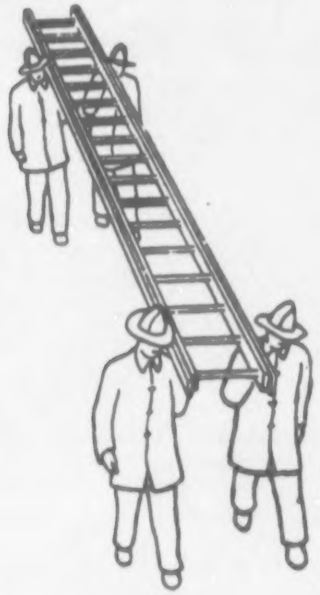


Figure 20. Four Man Ladder Carry.

Procedures for raising the extension ladder (minimum three men).

1. Remove the ladder from the apparatus.

2. Lift the ladder from the ground as recommended in the two or four man carry.

3. Carry ladder to desired location, spacing the ladder before it is raised. (The heel man does the spacing.)

4. Lay the ladder down with the beams of the bed on the ground.

5. The heel man, number 1 man, will stand on the heel plate, reach forward grasping the rung with both hands and assist in raising.

6. The number 2 and 3 men will space themselves about one-third distance from the top of the ladder facing the top. They will then reach down with their inside hands, grasp the rung, and raise the ladder, turning their bodies while raising the ladder, thus facing the heel or butt of the ladder.

7. They will then walk toward the heel of the ladder hand over hand, using the beams, until the ladder is in the upright position.

Note: All men should watch the top of the ladder.

8. To raise the fly, the number 1 man will be on the building side and the number 2 man on the outside to steady the ladder while the number 3 man raises the fly. The number 2 man steps back letting the ladder lean slightly away from the building to counteract the strain made by pulling the halyard.

9. The man underneath the ladder locks the pawls or dogs by pulling down on the halyard from the underside.

10. The ladder is then lowered onto the building by all three men. The man on the outside of the ladder places one foot on the lower rung to steady the ladder.

11. The halyard is then secured to a rung of the bed as an added safety precaution in the event the pawls or dogs are not locked.

Note: To lower the ladder, the procedures are reversed.

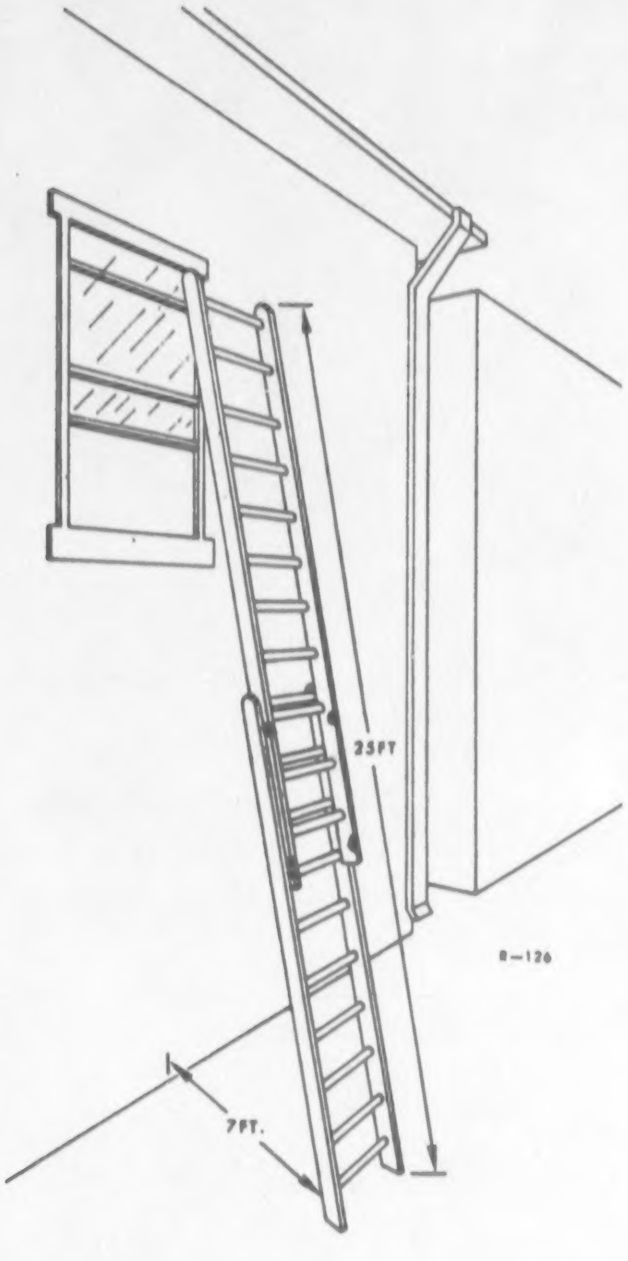
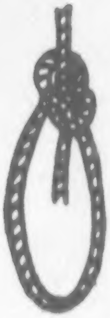
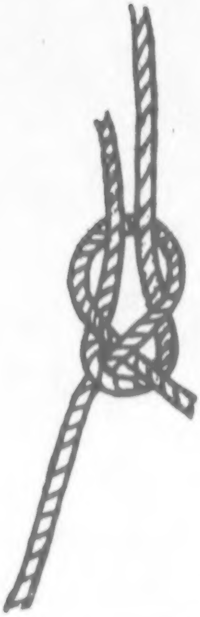
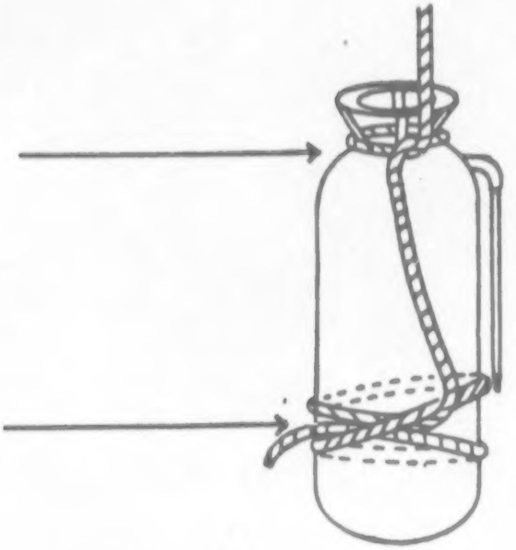

25FT
7FT.
R-126

Figure 21. Positioning a Ladder.

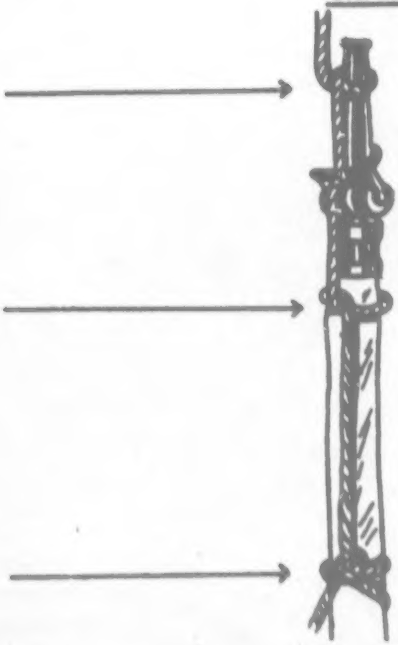
Identify the following knots or hitches.



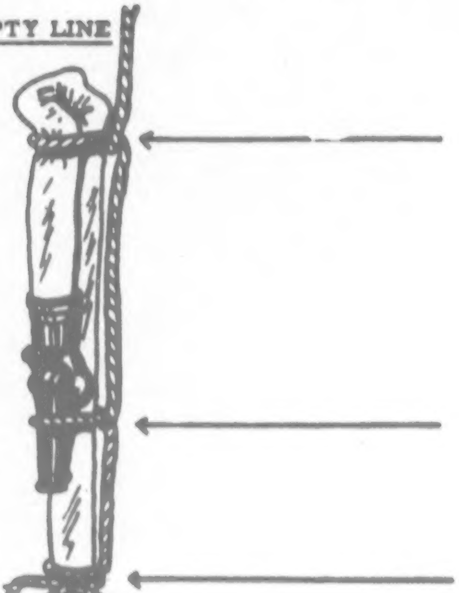




CHARGED LINE



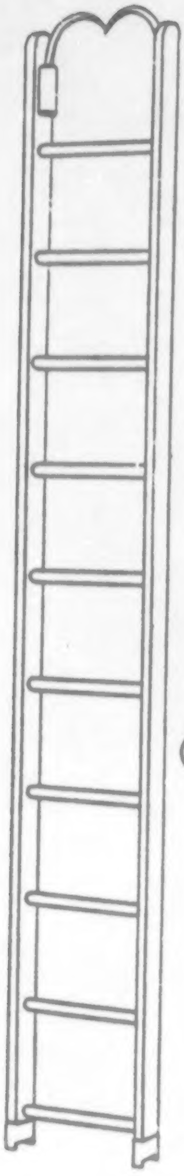
EMPTY LINE



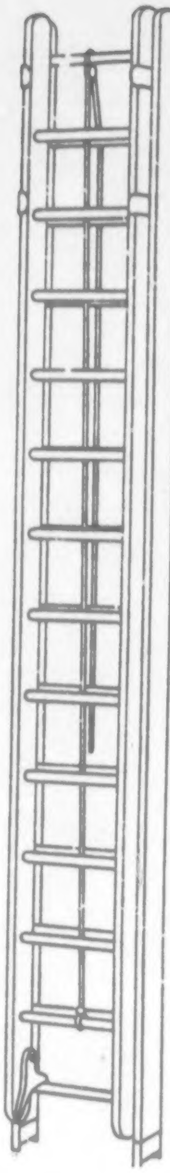
Identify the two ladders

1. ____________________

2. ____________________



①



②

Technical Training

17-2

Fire Protection Specialist

HYDRAULICS

11 June 1975

CHANUTE TECHNICAL TRAINING CENTER (ATC)

This supersedes 3ABR57130-1-PT-306, 5 February 1973.
OPR: TWS
DISTRIBUTION: X
TWS - 1000; TTSVR - 2

Designed For ATC Course Use

DO NOT USE ON THE JOB

FOREWORD

Upon completion of this programmed text, each student will be able to accomplish the following tasks.

1. Match a list of hydraulic terms used in the Fire Service with their definitions with 80% accuracy.

2. Given an operators guide plate and a list of hose lays of various lengths, each student will demonstrate proficiency selecting the correct pump pressure on operating equipment.

3. Given a list of hose lays of various lengths and nozzle tip sizes, the student will use the rule of thumb to compensate for friction loss and select the correct pump pressure required to maintain 50 psi nozzle pressure on operating equipment.

4. State the principles of drafting water.

This PT has been validated by 30 students enrolled in the 3ABR57130-1 Course and has been in continuous use since 1966.

STANDARD INSTRUCTIONS

Basic rules of taking a programmed text is to always check your answer before proceeding with the program. In other words, MAKE SURE THAT YOU ARE CORRECT EVERY TIME YOU MAKE A RESPONSE. If at any time you find that your answer has been incorrect, then you should go back and redo the last frame using the correct response. Bear this rule in mind: After making a response, (record your answers on a separate sheet of paper) verify your answers. MAKE SURE THAT YOU HAVE BEEN CORRECT.

Various symbols are used as cues and to indicate the number of words that the response should have. These symbols are:

(1) In some cases a response will need more than one word. This can be indicated by the number of blanks to be filled in. For example, a response that needs three words might show three individual blanks, such as ______ ______ ________. Counting the number of blanks tells you that three words must be used.

(2) Another method of indicating that more than one word is required is to use an asterisk (*) above the blank, such as: *__________________. Any time this symbol is used, you must use more than one word as your response.

(3) Finally, we find that some frames are extremely important and a correct response to these is more essential than one to the common types of frames. These frames are indicated by a double asterisk, such as **__________________. In all cases you should try to answer these by using your own words. Remember there is always more than one way to say something, so any time you run across a blank using **_________ you should try to phrase your answer in your own words, based upon what you have learned from the previous frames.

For your convenience, these symbols are listed below:

(1) ________ _________ (More than one blank: means one word for each blank).

(2) *_________ The asterisk indicates that the response must have more than one word (this symbol is often used in place of individual blanks for each word).

(3) **___________ This indicates an extremely important frame and should be phrased in your own words.

The remainder of the instructions will be based on the correct way of participating in this program and will be in program form themselves. Remember the rules, look for the cues to the proper response in the first frame and build on this in subsequent frames. Always look to the left of the next frame, after making a response, to make sure that you are correct. Do not go on to the next frame until you understand the correct response to the last frame.

PROCEED TO THE FIRST FRAME

ANSWER COLUMN	COVER THE ANSWER COLUMN FIRST
	1. This lesson is developed in a series of small steps called frames. For example, you are now reading information provided for you in the first ______ (Copy in your answer on a separate sheet of paper). After you have recorded your answer, move your card down on the Answer Column and check your answer.
Frame	2. This is the ______ frame in this series. You will find the correct answer to it to the (right, left) _____ of the next frame below.
second (or Nr. 2), left	2A. The answer column should be kept covered until you have written the answer to each ______.
frame	2B. See, the program is easy! Often the answer is included in the same frame. Use it - don't make a test out of the program! No response required to this frame!
No response required to the previous frame	3. A blank, in a frame having one asterisk (*______) means: "more than one word". Any time you see one asterisk above a blank you should make your answer (response) contain more than *______.
one word	4. Many blanks will require a response of more than *______. In fact, the response you just made contains ______ than *______.
one word more one word	5. Any time you see an asterisk (*) above a blank you should make your response contain *____________________.
more than one word	6. One asterisk (*) above a blank means **____. (Note: Refer to the instructions for the meaning of the double asterisk).
that you reponse must contain more than one word Note: Any answer that you make, in your own words, that means the same as the above answer is always acceptable on a double ** frame.	7. Some frames will show individual blanks for each word of your response. For example, a response requiring two words could have __________ _______________.
	8. At this time you should be ready to begin the program on Basic fire protection hydraulics. Turn to frame 9 of the program and begin.

	9. The study of liquids at rest or in motion is called hydraulics. The study of water flow, for example, would be called ____________.
hydraulics	10. To study liquids at rest or in motion, you must study ______________.
hydraulics	11. When water is forced through a nozzle, pressure is created and this pressure is called nozzle pressure; thus, when pressure is created at the nozzle it is called * ____________________________.
nozzle pressure	12. When pressure is created at the nozzle, it is called * __________________.
nozzle pressure	13. The term "pounds per square inch" may be abbreviated at PSI. To abbreviate 50 pounds per square inch, you would write 50 ______________.
psi	14. As we refer to pounds per square inch as ____________, we may also use gpm for gallons per minute. 300 gallons per minute could be written 300 _________.
psi gpm	15. Pressure is always in psi and discharge is always in _________. Thus nozzle pressure will always be in ________ and discharge will be in ___________.
gpm psi gpm	16. Standard Air Force nozzle pressure is 50 pounds per square inch. This means that pressure at the nozzle should be * _____________ _______________.
50 psi	17. When one says the pressure at the nozzle is 50 psi, he is saying the nozzle is operating at * ______________________.
standard nozzle pressure (50 psi)	18. A 1-inch nozzle will discharge 209 gpm at * ______________________ ______________. At 50 psi a 1-inch nozzle will discharge _________ gpm.
standard nozzle pressure (50 psi) 209	19. The abbreviation for "gallons per minute" is _________. The discharge from a 1-inch nozzle could be expressed as * _______________.

gpm 209 gpm	20. A 1-inch nozzle will discharge *________________________at *________________________of *________________________.
209 gpm standard nozzle pressure 50 psi	21. A 1-1/8 inch nozzle will discharge 265 gpm. This means at *__________ a 1-1/8 inch nozzle will discharge *__________________________.
50 psi (standard nozzle pressure) 265 gpm	22. At *__________pressure, a 1-1/8 inch nozzle will discharge *__________________________.
standard nozzle (50 psi) 265 gpm	23. At *__________a 1-1/8 inch nozzle will discharge ________and a 1-inch nozzle will discharge *________.
standard nozzle pressure (50 psi) 265 gpm 209 gpm	
	24. At standard nozzle pressure of _____, a 1-1/4 inch nozzle will discharge 326 gpm; thus at 50 psi a 1-1/4 inch nozzle will discharge *____________________.
50 psi 326 gpm	25. At standard nozzle pressure, a 1-1/4 inch nozzle will discharge *__________.
326 gpm	26. At *__________, a 1-1/4 inch nozzle will discharge *____________ and a 1 inch nozzle will discharge *____________________.
standard nozzle pressure (50 psi) 326 gpm 209 gpm	27. At 50 psi a 1-1/8 inch nozzle will discharge *__________ and a 1-1/4 inch nozzle will discharge *__________.
265 gpm 326 gpm	28. At standard nozzle pressure, a 1 inch nozzle will discharge *____________, and 1-1/8 inch nozzle will discharge *_____ and a 1-1/4 inch nozzle will discharge *____________.
209 gpm 265 gpm 326 gpm	29. The study of nozzle pressure and gallon flow per minute from various size nozzles is in the study of __________.
hydraulics	30. In fire pumps, impellers are used to force water thru the pump. Thus water is impelled or forced thru the pump by means of ______________.

impellers	31. When water is forced thru a pump, it is done by ____________________.
impellers	32. A pump with only one impeller is a single stage pump. Therefore, any pump having only one impeller would be a * ____________________ pump.
single stage	33. A pump with only one impeller would be a * ______________ while a pump with more than one is a multiple stage pump. Any pump with two impellers is a * ______________ pump.
single stage pump multiple stage	34. A pump with more than one impeller is called a * ____________________.
multiple stage pump	(REVIEW) 35. Thus far in this program you have learned that the study of liquids at rest and in motion are in the study of ______________, that standard AF nozzle pressure is * __________, and at this pressure, a 1 inch nozzle will discharge * ________________, and a 1-1/8 inch nozzle will discharge * __________ and a 1-1/4 inch nozzle will discharge * __________. You have also learned a pump with one impeller is a * ______________ pump, while a pump with more than one impeller is a * ____________________ pump.
hydraulics 50 psi 209 gpm 265 gpm 326 gpm single stage multiple stage	36. The pump operator has a guide plate to assist him in the operation of the pump. When the pump operator needs assistance he should use the * __________________.
guide plate	37. For assistance in the operation of the pump, the pump operator should use the * ________________________.

guide plate	38. The figure below is a pump operator's guide plate. It shows a 1 inch nozzle will discharge * __________ at * __________ and a 1-1/8 inch nozzle will discharge * __________ at * __________.

SIZE OF NOZZLE	G.P.M.	PRESSURE OF NOZZLE IN POUNDS	LENGTH OF 2 1/2-INCH HOSE LAYOUT									
			100	200	300	400	500	600	700	800	900	1000
			REQUIRED PRESSURE AT PUMP									
1"	209	50	62	73	84	95	106	117	128	139	150	160
1 1/8"	265	50	69	86	103	120	137	154	171	188	205	222
1 1/4"	326	50	78	103	128	153	178	203	228	253	278	303

(Parallel Volume)

(Series Pressure)

209 gpm 50 psi 265 gpm 50 psi	39. The pump operator must know the size nozzle and amount of hose laid in order to determine pump pressure; thus, to determine pump pressure the operator must know * __________.
size of nozzle and amount of hose laid	40. The pump operator knows the nozzle size, but before he can determine the right pump pressure he must also know * __________.
the amount of hose laid	41. If only the amount of hose laid is known, before determining pump pressure the operator must know the * __________.
nozzle size	42. Pump pressure is the discharge pressure at the pump. Nozzle size and hose layout determine the correct * __________.
pump pressure	43. In order for the pump operator to determine * __________ he must know ** __________.

pump pressure
size of nozzle and amount of hose laid out

44. In the figure below you will note under "size of nozzles" three standard nozzle sizes; they are *______________ ______________ inch.

SIZE OF NOZZLE	G.P.M.	PRESSURE OF NOZZLE IN POUNDS	LENGTH OF 2 1/2-INCH HOSE LAYOUT 100	200	300	400	500	600	700	800	900	1000 REQUIRED PRESSURE AT PUMP
1"	209	50	62	73	84	95	106	117	128	139	150	160
1 1/8"	265	50	69	86	103	120	137	154	171	188	205	222
I 1/4"	326	50	78	103	128	153	178	203	228	253	278	303

(Parallel Volume) (Series Pressure)

1"
1-1/8" and
1-1/4"

45. A 1 inch nozzle will discharge *______________. According to the guide plate, what will the other two nozzles discharge *______________ and *______________.

SIZE OF NOZZLE	G.P.M.	PRESSURE OF NOZZLE IN POUNDS	LENGTH OF 2 1/2-INCH HOSE LAYOUT 100	200	300	400	500	600	700	800	900	1000 REQUIRED PRESSURE AT PUMP
1"	209	50	62	73	84	95	106	117	128	139	150	160
1 1/8"	265	50	69	86	103	120	137	154	171	188	205	222
1 1/4"	326	50	78	103	128	153	178	203	228	253	278	303

(Parallel Volume) (Series Pressure)

209 gpm
265 gpm
326 gpm

46. The size of the nozzle and amount of hose layout will determine the *__________.

pump pressure

47. Pump pressure is also shown on the guide plate below. From this, if the operator knows the *____________________
and *______________________________
he can determine the *____________________.

SIZE OF NOZZLE	G.P.M.	PRESSURE OF NOZZLE IN POUNDS	LENGTH OF 2 1/2-INCH HOSE LAYOUT REQUIRED PRESSURE AT PUMP									
			100	200	300	400	500	600	700	800	900	1000
1"	209	50	62	73	84	95	106	117	128	139	150	160
1 1/8"	265	50	69	86	103	120	137	154	171	188	205	222
1 1/4"	326	50	78	103	128	153	178	203	228	253	278	303

(Parallel Volume) (Series Pressure)

size nozzle
amount of hose layout
pump pressure

48. Since pump pressure is given in psi, using the figure above with 100 feet of hose laid out, using 1 inch nozzle the pump pressure would be *__________________.

62 psi

49. In the figure below to discharge 265 gpm the nozzle size would be *_____________
and with 200 feet of hose layout, the pump pressure would be *_____________________.

SIZE OF NOZZLE	G.P.M.	PRESSURE OF NOZZLE IN POUNDS	LENGTH OF 2 1/2-INCH HOSE LAYOUT REQUIRED PRESSURE AT PUMP									
			100	200	300	400	500	600	700	800	900	1000
1"	209	50	62	73	84	95	106	117	128	139	150	160
1 1/8"	265	50	69	86	103	120	137	154	171	188	205	222
1 1/4"	326	50	78	103	128	153	178	203	228	253	278	303

(Parallel Volume) (Series Pressure)

1-1/8 inch
86 psi

50. Using the guide plate, a layout of 600 feet of hose with a 1-inch nozzle the pump pressure would be *__________________.

117 psi

51. From the guide plate, if we use a 1-1/4 inch nozzle with 300 feet of hose layout, the pump pressure would be *______________.

SIZE OF NOZZLE	G.P.M.	PRESSURE OF NOZZLE IN POUNDS	LENGTH OF 2 1/2-INCH HOSE LAYOUT									
			100	200	300	400	500	600	700	800	900	1000
			REQUIRED PRESSURE AT PUMP									
1"	209	50	62	73	84	95	106	117	128	139	150	160
1 1/8"	265	50	69	86	103	120	137	154	171	188	205	222
1 1/4"	326	50	78	103	128	153	178	203	228	253	278	303

(Parallel Volume) (Series Pressure)

128 psi

52. Using a 1-1/8 inch nozzle with 500 feet of hose layout, according to the guide plate the pump pressure is *____________________________.

SIZE OF NOZZLE	G.P.M.	PRESSURE OF NOZZLE IN POUNDS	LENGTH OF 2 1/2-INCH HOSE LAYOUT									
			100	200	300	400	500	600	700	800	900	1000
			REQUIRED PRESSURE AT PUMP									
1"	209	50	62	73	84	95	106	117	128	139	150	160
1 1/8"	265	50	69	86	103	120	137	154	171	188	205	222
1 1/4"	326	50	78	103	128	153	178	203	228	253	278	303

(Parallel Volume) (Series Pressure)

137

53. Using a 1-1/4 inch nozzle with 600 feet of hose layout, the pump pressure would be *________________.

SIZE OF NOZZLE	G.P.M.	PRESSURE OF NOZZLE IN POUNDS	LENGTH OF 2 1/2-INCH HOSE LAYOUT									
			100	200	300	400	500	600	700	800	900	1000
			REQUIRED PRESSURE AT PUMP									
1"	209	50	62	73	84	95	106	117	128	139	150	160
1 1/8"	265	50	69	86	103	120	137	154	171	188	205	222
1 1/4"	326	50	78	103	128	153	178	203	228	253	278	303

(Parallel
Volume)

(Series
Pressure)

203 psi

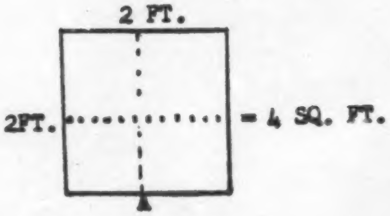
54. With a 900 feet hose layout, using a 1-1/8 inch nozzle, the pump pressure is *____________________.

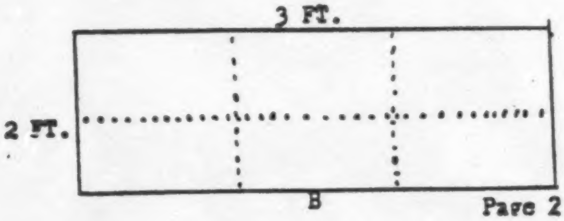
SIZE OF NOZZLE	G.P.M.	PRESSURE OF NOZZLE IN POUNDS	LENGTH OF 2 1/2-INCH HOSE LAYOUT									
			100	200	300	400	500	600	700	800	900	1000
			REQUIRED PRESSURE AT PUMP									
1"	209	50	62	73	84	95	106	117	128	139	150	160
1 1/8"	265	50	69	86	103	120	137	154	171	188	205	222
1 1/4"	326	50	78	103	128	153	178	203	228	253	278	303

(Parallel
Volume)

(Series
Pressure)

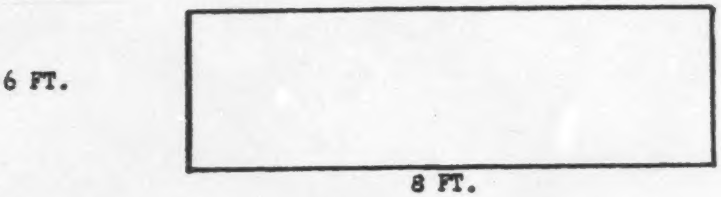
205 psi	55. Thus far you have learned the meaning of hydraulics, gallon flow per minute from various nozzles, the difference between single stage and multiple stage pumps and the use of the pump operator's guide plate. We will now go into rule of thumb. This includes measurement and weights and their relationship to the fire service.
No response required	56. Measuring the area of a room we multiply length x width. If you want to find the area of a room, lot, etc., you simply multiply ________________ x ________________.
length x width	57. To arrive at an answer in square feet, we multiply * ________________ as in figure "A". What is the area of figure "B" * ________________.





Page 2

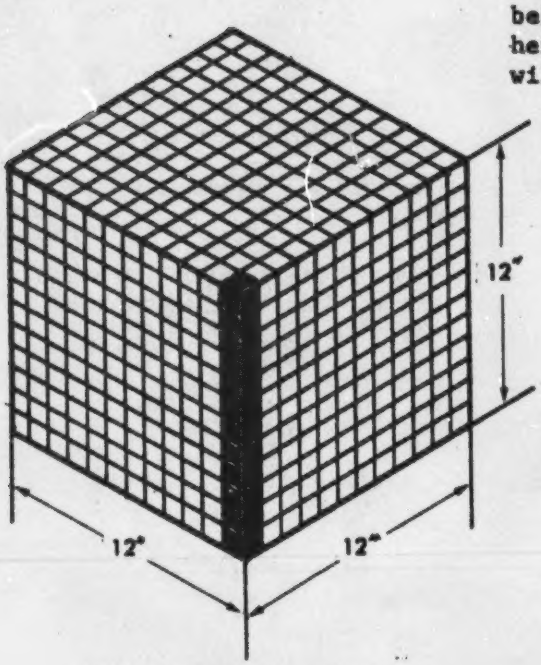
length and width 6 sq ft	58. A room 10 feet long and 10 feet wide will have an area of * ________________.
100 sq ft	59. The area will usually be in square feet; therefore, measurements in square feet will usually be the ________________.
area	60. To find the ____________ of a room we multiply ____________ x ____________.
area length x width	61. The __________ of this figure is * ________________.



area 48 sq ft	62. To find volume we multiply area x height. If you know the area and the height and you want to know the volume you should * ____________________ x ______________________________.
multiply area x height	63. The area of a tank is in square yards and is 10 yards high. To find the volume you must * ____________ x ____________.
multiply area x height (multiply area x 10)	64. Volume is given in cubic measurement, so when you multiply area x height, the volume will be in * ____________________.
cubic measurement	65. When multiplying area x height, the volume will be in * ________________ and when multiplying length by width, the area will be in * ____________________.
cubic measurement square measurement	66. Any figure in cubic measurement will be the volume; thus if a tank holds 100 cubic feet of water, this is its ____________.
volume	67. A tank that has an area of 10 square feet and is 5 feet high would have a ____________ of ______________.
volume 50 cu. ft.	68. A tank has a volume of 50 cubic feet. We arrived at this measurement by * ______ ________________ x ________________.
multiplying area x height	69. Multiplying area x height gives you the ____________; for example, an area of 5 square feet with a height of 5 feet will have a __________ of * ______ ____________________.
volume volume 25 cu. ft.	70. A warehouse on XYZ Air Force base measures 130 feet wide, 260 feet long, and a ceiling height of 30 feet. The area of the warehouse is * __________ and it has a volume of * ________________.
33,800 square feet 1,014,000 cubic feet	71. To get area in square measurement we ** ____________________________ and to get volume in cubic measurement we ** ______________________________.
multiply length and width multiply area and height	72. When multiplying length x width, we get ____________ in * ____________ ____________ and multiplying area x height, we get __________ in * __________.

area square measurement volume cubic measurement	73. The Fire Service uses many "Rule of Thumb" (RT) figures. Figures that are adjusted for easier use are termed * ________________________ figures.
Rule of thumb	74. The term "Rule of Thumb" may be abbreviated as RT; thus Rule of Thumb may be written as ______________.
RT	75. If you wish to abbreviate Rule of Thumb you may do it with _______________.
RT	76. The figure 8.33 lbs may be adjusted to read 8.3 lbs for easier use. The adjusted figure 8.3 lbs becomes a * ________ ____________________.
Rule of Thumb (RT)	77. The (RT) weight of one gallon of water is 8.3 lbs. The figure for the weight of one gallon water, which is * _________________ is a * _________________
8.3 lbs rule of thumb (RT)	78. At 50 psi nozzle pressure a 1 inch nozzle will discharge ______________gpm, if the water is discharged for 3 minutes, there would be ___________ gallons discharged and it would weigh _________ lbs.
209 627 5,204.1	79. The (RT) weight of one gallon of water is * ______________. Therefore, to find the weight of 10 gallons of water you would multiply 10 x * _______________.
8.3 lbs 8.3 lbs	80. There are 231 cubic inches in one gallon of water. With this in mind we could say one gallon will weigh* __________ and contain * ____________ inches.
8.3 lbs 231 cubic	81. One gallon of water contains 231 cubic inches and would weigh* __________ thus, using RT, two gallons of water might weight * ____________ and contain * ______________________________________.
8.3 lbs 16.6 lbs 462 cubic inches	82. The RT weight of one gallon of water is * ____________ and contains * ________ ____________________.
8.3 lbs 231 cu. in.	83. There are 693 cubic inches in 3 gallons of water. We arrived at this answer by multiplying 3 times the cubic inches per one gallon of water, which is ______________.

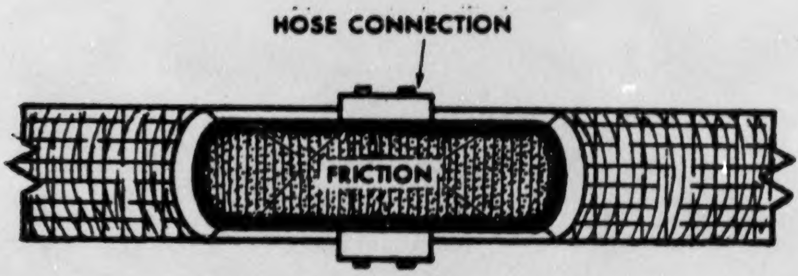
231	84. The measurements of the figure below are; length 12", width 12" and height 12", which means one cubic foot will contain ________________cubic inches.



One Cubic Foot of Water

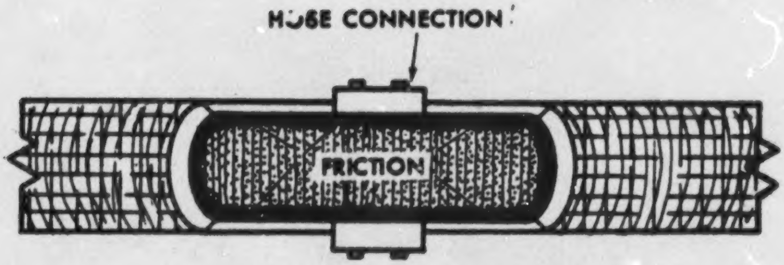
1,728 cubic inches	85. The figure above shows one cubic foot of water. By multiplying area in square inches x __________ in inches would mean one cubic foot contains * ____________________________.
height 1,728	86. One cubic foot of water contains * ____________, while one gallon of water contains * ___________ and the weight of one gallon of water is (RT) * ________________________________.
1,728 cu. in 231 cu. in 8.3 lbs	87. One cubic foot of water will weigh 62.5 lbs and contain _________ cubic inches. This would mean 1,728 cubic inches of water will weigh * __________.
1,728 62.5 lbs	88. One cubic foot or 7.5 gallons of water will weigh* ___________ and contain ___________ cubic inches. From this 1,728 cu. inches of water would equal ___________ gallons of water.
62.5 lbs 1,728 7.5	89. One cubic foot will hold ___________ gallons of water and would weigh * ___________ we could also say that 1,728 cu. in. will weigh * ___________ because 1,728 cu. in. is equal to one * ____________.

7.5 62.5 lbs 62.5 1 cubic foot	90. There are 7.5 gallons (RT) in one cubic foot. Therefore two cubic feet might hold ______ gallons.
15	91. The number of gallons in one cubic foot is * ______ while the number of cubic inches in one cubic foot is ______.
7.5 gallons 1,728	92. One cubic foot will hold ______ gallons of water. Therefore, a swimming pool with a volume of 3,500 cu. ft. would hold ______ gallons of water.
7.5 26,250	93. A cubic foot of water will weigh * ______ and contain * ______ and hold ______ gallons.
62.5 lbs 1,728 cu. in 7.5	94. One gallon of water will weigh (RT) * ______ and contain ______ cubic inches.
8.3 lbs 231	95. The weight of one cubic foot of water is ** ______. The number of gallons a cubic foot will hold is ** ______. The weight of one gallon of water is ** ______. The number of cubic inches in one gallon of water is ** ______.
62.5 lbs 7.5 gals 8.3 lbs 231 cu. in.	96. Friction loss is the pressure lost due to friction; (see figure below) thus, friction loss is the loss of ______ due to friction.



CROSS SECTION 2 1/2" FIRE HOSE

pressure	97. Friction loss in a hose is a loss of _______________ due to friction; and this loss of _____________ is called * ____________________.
pressure pressure friction loss	98. In the figure below, water rubbing against the inside of the hose causes ______________________.



CROSS SECTION 2 1/2" FIRE HOSE

Friction	99. When water rubs against the inside of the hose it causes ________________, resulting in a loss of _______________.
Friction pressure	100. A pump produces 100 psi and the nozzle at the end of 500 feet of hose has only 50 psi pressure. The pressure lost is due to ________________ and is called * ____________________.
friction friction loss	101. Pump pressure is 200 psi, nozzle pressure is 50 psi. The loss of 150 psi of pressure is due to friction. From this we could say friction loss is the * ______________________________________.
loss of pressure due to friction	102. Friction loss is overcome by increasing pump pressure, so in order to overcome * _________________ you must increase * ___________________________.
friction loss pump pressure	103. Friction loss in hose is determined by the size of the nozzle; for example, standard nozzles, which are * _____, ______ and _________ inch, will have different rates of * ________________________.

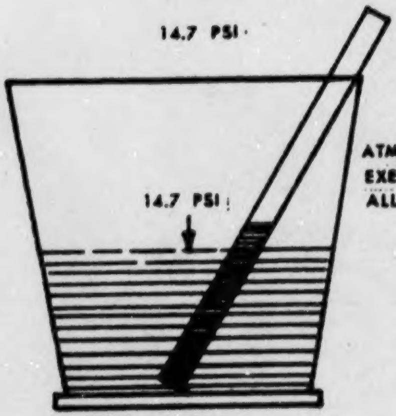
1, 1-1/8 and 1 1/4 friction loss	104. Friction loss is determined by the size of the nozzle and the amount of hose lay out. If the pump operator must determine the amount of friction loss, he must first know *______________________ ___________________________________.
size of nozzle and amount of hose laid out	105. Using a 1-inch nozzle, the friction loss per 100 feet of 2 1/2 inch hose is 10 psi (RT). This means each 100 feet of 2 1/2 inch hose will have *____________ friction loss.
10 psi	106. Using 2 1/2 inch hose, the friction loss for a 1 inch nozzle per 100 feet is *___________________; thus, the friction loss in 200 feet would be *______________.
10 psi 20 psi	107. Using a 1 inch nozzle, the friction loss for 500 feet of 2 1/2 inch hose would be *___________________________________.
50 psi	108. A pump must overcome 60 psi of friction loss and the nozzle in use is a 1 inch nozzle. The amount of 2 1/2 inch hose laid out is *________________________. REMEMBER: Using a 1 inch nozzle on 2 1/2 inch hose the friction loss is 10 psi per each 100 feet.
600 feet	109. Friction loss, using a 1-1/8 inch nozzle is 18 psi per 100 feet of 2 1/2 inch hose. Using a 1 inch nozzle, the friction loss is *__________________ and using a 1-1/8 inch nozzle it is *__________.
10 psi 18 psi	110. Friction loss per 100 feet of 2 1/2 inch hose using a 1-1/8 inch nozzle is *______________________.
18 psi	111. With 200 feet of 2 1/2 inch hose laid out, using a 1-1/8 inch nozzle, the friction loss should be *______________ and using a 1 inch nozzle, it would be *________________________.
36 psi 20 psi	112. There is 700 feet of 2 1/2 inch hose laid out and there is 126 psi friction loss. The nozzle in use must be a *_____________________________.

1-1/8 inch	113. Using a 1 1/4 inch nozzle, there is 25 psi friction loss per 100 feet of 2 1/2 inch hose. Therefore, the friction loss in 300 feet would be *________________.
75 psi	114. Using a 1 1/4 inch nozzle with 100 feet of 2 1/2 inch hose laid out, the friction loss would be *________________.
25 psi	115. If a 1 1/4 inch nozzle is in use and there is 100 psi friction loss then there must be ______________ feet of 2 1/2 inch hose laid out.
400 feet	116. The friction loss per 100 feet of 2 1/2 inch hose using a 1 inch nozzle is *_____________ and using a 1-1/8 inch nozzle is *________________ and using a 1 1/4 inch nozzle is *___________________.

REVIEW

10 psi 18 psi 25 psi	117. At this point in your program you have learned that the pump operator must know two things when determining pump pressure; the amount of hose laid and the size of the ________________. You should know that to determine friction loss the pump operator should know the same two things as when determining pump pressure. With this in mind the two things the pump operator must know to determine friction loss is *_______________ and *____________. You have also learned many "Rule of Thumb" figures, some of which are; the weight of one gallon of water, which is *_________ that the number of gallons in one cubic foot is ______________ that one gallon of water contains _____________ cubic inches and that in one cubic foot there are ______________ cubic inches.
nozzle amount of hose laid and size of nozzle 8.3 lbs 7.5 231 1,728	AT THIS TIME YOU SHOULD TAKE A 10-MINUTE BREAK. AFTER YOUR BREAK, RETURN TO YOUR PROGRAM.
	118. At this point we will take up Suction and Drafting, along with the advantages and disadvantages of fire streams.
No Response Required	

	119. The word atmosphere refers to the air that surrounds the earth. For example, the air we breathe is referred to as ____________________.
atmosphere	120. The air that surrounds the earth is called ____________________.
atmosphere	121. Since the atmosphere exerts pressure, it is called "atmospheric pressure" and and is given in psi. For example, the *________________ is 14.7 psi at sea level.
atmospheric pressure	122. Pressure is applied on all things equally by the ____________________.
atmosphere	123. Atmospheric pressure at sea level is 14.7 psi; thus, the pressure exerted at sea level by the __________ is *____________________.
atmosphere 14.7 psi	124. Atmospheric ___________ exerts equal pressure on all things. For example, a surface of water at sea level will have a _________ exerted on it of *___________.
pressure pressure 14.7 psi	125. Atmospheric ___________ is exerted at *_________________ in the amount of *_______________________.
pressure sea level 14.7 psi	126. Atmospheric pressure is exerted equally in all directions. In the figure below it is easy to see that the __________ is exerted equally *______________________.



ATMOSPHERIC PRESSURE IS EXERTED EQUALLY IN ALL DIRECTIONS

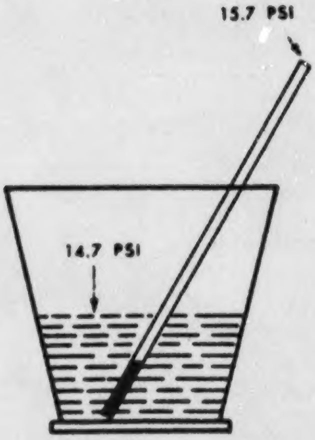
Figure A

pressure
in all directions

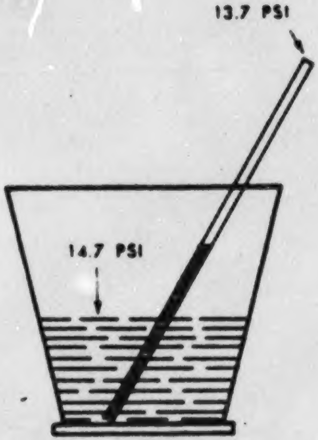
127. Any object coming in contact with the atmosphere at sea level will have pressure exerted upon it equally *__________ of *__________________________.

in all directions
14.7 psi

128. In figure "B" pressure in the straw has been increased to *______________ causing the water to go down. In figure "C" pressure has decreased to *__________. causing the water *______________________.



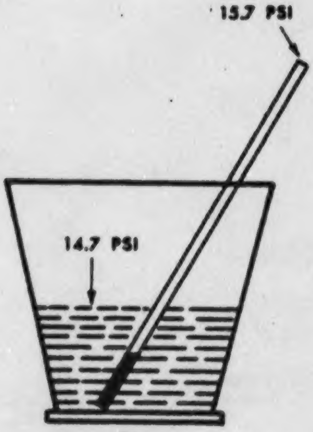
B



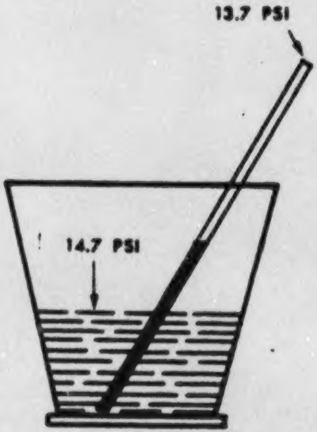
C

15.7 psi
13.7 psi
to go up

129. In figure "C" pressure in the straw has decreased which will cause the water in the straw to *______________________.



B



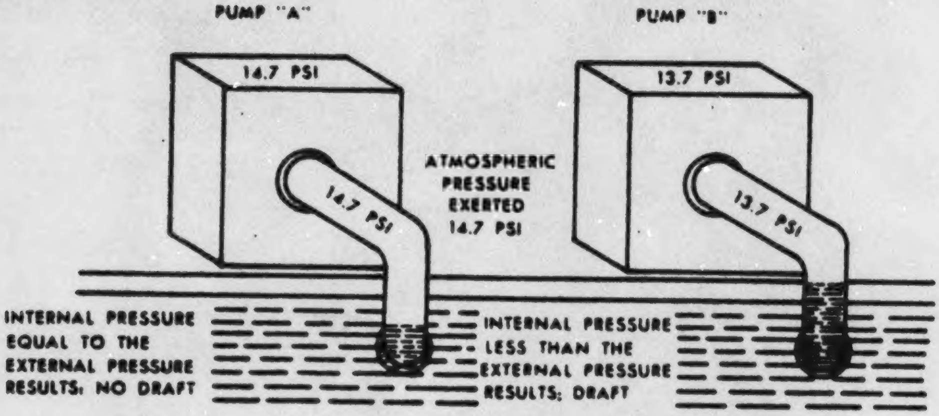
C

go up

130. If pressure exerted on water is equal on all sides water will not move, but if pressure is increased or decreased on one side water *______________________.

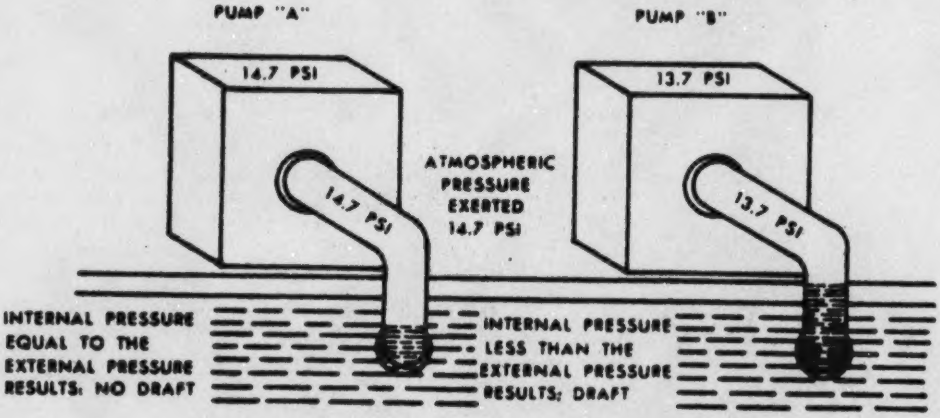
will move

131. In figure "A" the pressure is equal on all sides and the water * ____________ move, but in figure "B" the pressure is not equal and the water * ______________________.


PUMP "A"
PUMP "B"
14.7 PSI
14.7 PSI
13.7 PSI
13.7 PSI
ATMOSPHERIC PRESSURE EXERTED 14.7 PSI
INTERNAL PRESSURE EQUAL TO THE EXTERNAL PRESSURE RESULTS: NO DRAFT
INTERNAL PRESSURE LESS THAN THE EXTERNAL PRESSURE RESULTS: DRAFT

will not
will move

132. When the pump decreases pressure in the hose (figure B) water will rise toward the pump. The more pressure decreases the higher water will * ______________ the pump.


PUMP "A"
PUMP "B"
14.7 PSI
14.7 PSI
13.7 PSI
13.7 PSI
ATMOSPHERIC PRESSURE EXERTED 14.7 PSI
INTERNAL PRESSURE EQUAL TO THE EXTERNAL PRESSURE RESULTS: NO DRAFT
INTERNAL PRESSURE LESS THAN THE EXTERNAL PRESSURE RESULTS: DRAFT

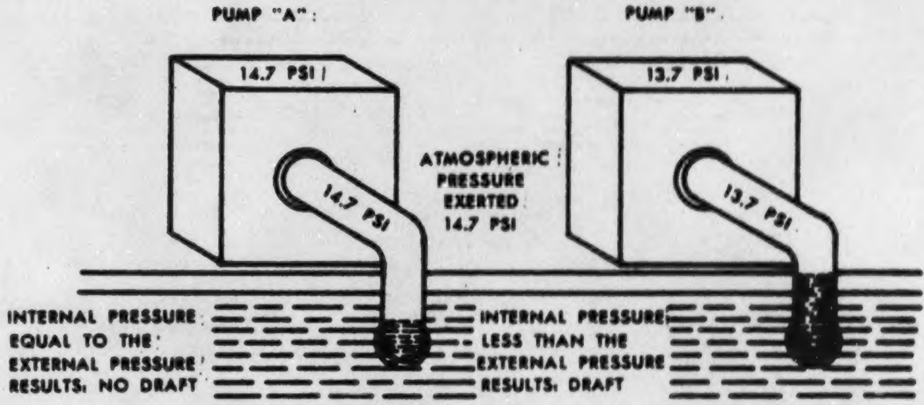
rise toward

133. If the pressure in the hose is 13.7 psi and is decreased to 12.3 psi, this simply means water * __________ higher in the hose.

will rise

134. Once the water begins to ________ in the hose, the pump is said to be drafting; thus, for water to ________ in the hose the pump must be __________.

rise rise drafting	135. The pump decreased pressure in the hose causing a draft. If the pressure in the hose is less than the pressure outside, then the pump will ____________.
draft	136. In figure "A" the pump will not ______________ but in figure "B" the pump will ___________ because **__________ _________________________.


PUMP "A"
PUMP "B"
14.7 PSI
14.7 PSI
13.7 PSI
13.7 PSI
ATMOSPHERIC PRESSURE EXERTED 14.7 PSI
INTERNAL PRESSURE EQUAL TO THE EXTERNAL PRESSURE RESULTS: NO DRAFT
INTERNAL PRESSURE LESS THAN THE EXTERNAL PRESSURE RESULTS: DRAFT

draft draft the pressure is less inside the hose, than it is outside the hose	137. When the pressure in the suction hose is decreased .434 psi water will be drafted 1 foot high. To draft water 1 foot high, pressure must be decreased ______________________.
.434 psi	138. The amount of pressure decrease necessary in a suction hose to draft water 1 foot high is *________________.
.434 psi	139. To draft water two feet high would require a pressure decrease in the suction hose of *___________________.
.868	140. If a pump decreases pressure in the suction hose 1 psi, water will rise 2.304 feet thus, a 1-psi decrease of pressure in the suction hose would cause the water to be drafted or rise *_________.
2.304	141. A 2-psi decrease of pressure in the suction hose would cause the water to *____________________________ high.

rise 4.608 feet	142. With a 1-psi pressure decrease in the suction hose, water will be drafted *______________ high. Therefore, with a 3-psi decrease water would be drafted *________________ high.
2.304 feet 6.912 feet	143. If the pressure in the suction hose is 10.5 psi and the atmospheric pressure on the outside is 13.5 psi the water will be *__________________ high.
drafted (raised) 6.912 feet	144. To draft water 2.304 feet we must decrease the _____________ in the suction hose *______________________.
pressure 1 psi	145. Standard AF fire pumps will not pump air; therefore, a device known as a pump-primer is used. In order to create a vacuum we must use a *___________.
pump-primer	146. A device used to create a vacuum is a *____________________________.
pump-primer	147. When a pump-primer decreases pressure in a suction hose below atmospheric pressure it is creating a vacuum. If the pressure in the base is 3 psi below *____________________. the pump-primer has __________________.
atmospheric pressure created vacuum	148. The height water will be drafted depends on how much vacuum the pump-primer creates. For example, if the pump-primer creates ___________enough to decrease pressure 1 psi, water will be *_____________________________.
vacuum drafted (raised) 2.304 feet high	149. When the pump-primer creates vacuum, the pressure in the suction hose _______________; thus the purpose for creating a vacuum is **__________ causing *___________________________.
decreases to decrease the pressure in the suction hose the water to rise (the water is drafted)	150. Assuming perfect conditions, water can be drafted to a maximum height of 33.9 feet. This would mean the best of pumps could not draft water over *____________________high.

33.9 feet	151. To find the maximum drafting height of water, which is *__________, we multiply atmospheric pressure x 2.304 feet. By multiplying these two, your answer would be the *________________.
33.9 maximum drafting height of water	152. Assuming perfect conditions, 33.9 feet is the figure for the **__________ ______________________________________
maximum drafting height of water	153. The fire service uses two types of fire streams, one of which is the fog stream. One type fire stream used in the fire service is the ______________ *______________________________________.
fog stream	154. Another type stream is the straight stream; thus, the two types of fire streams most generally used are the *__________________and the *______________.
fog stream straight stream	155. In the fire service two types of fire streams used are the *__________ and the *__________________________.
fog stream straight stream	156. Each type fire stream has its own advantages and disadvantages. In order to use these two fire streams effectively it is important to understand their ____________________ and ____________________________________.
advantages disadvantages	157. When using either fire stream, whether it is a *_______________ or a *__________________ the fire protection specialist should understand their ___________________and___________________.
fog stream straight stream disadvantages advantages	158. One advantage of a fog stream is its greater cooling effect. The fog stream covers more than the straight stream; thus, giving it a great *_______________.
cooling effect	159. Using a fog stream, more water surface is exposed to the heat over a larger area giving it a greater *_______ than a *_______________________________.
cooling effect straight stream	160. The more water surface exposed to the heat the greater the *__________ Therefore, if you want a greater cooling effect you must have more *___________ ______________________________________.

cooling effect water surface exposed to the heat	161. The greater the cooling effect the more **_____________________________.
water surface area exposed to the heat	162. One advantage of the fog stream is its *____________ while another is its smothering effect. Therefore, two advantages of the fog stream are its *_______________ and its *______________.
cooling effect cooling effect smothering effect	163. Applying a fog stream on a fire has two advantages; they are the *__________ and its *___________________________.
cooling effect smothering effect	164. Steam smothers a fire by displacing the oxygen. Therefore, to smother a fire by displacing the oxygen, water must be converted to _______________________.
steam	165. When water is applied on a fire by a fog stream it may be converted to _______, displacing the oxygen, thereby causing a *_________________________________.
steam smothering effect	166. The more water converted to steam the more oxygen it will displace. Therefore, to smother a fire with a fog stream, water must be *___________________________.
converted to steam	167. Smothering a fire with water,thus displacing the oxygen, is done by converting *__________________________.
water into steam	168. Water applied to a fire in the form of fog may be converted to ________ causing a *________________ while some of the water may absorb heat causing a *____________________________________.
steam smothering effect cooling effect	169. The fire service uses two general types of fire streams. They are:**_______ ______________________________________
fog stream straight stream	170. Two advantages of fog stream are: **____________________________________.
its cooling effect and its smothering effect	171. The cooling effect of a fog stream is the result of **_________________ and the smothering effect is the result of **__________________________.
a larger water surface exposed heat water being converted to steam displacing oxygen	172. A fog stream has a much shorter range than a straight stream, meaning a disadvantage of the fog stream is its *_________________________________.

shorter range	173. One disadvantage of the fog stream is its *__________.
shorter range	174. Another disadvantage of the fog stream is very little penetration; thus, two disadvantages of the fog stream are very little __________ and its *__________.
penetration shorter range	175. One disadvantage of the fog stream other than its short range, is very little __________.
penetration	176. Two disadvantages of a fog stream are **__________.
its shorter range and little or limited penetration	177. A fog stream is one type fire stream while another type is the *__________.
straight stream	178. The straight stream has a longer range than the fog stream. Therefore, one advantage of the straight stream is its *__________.
longer range	179. The straight stream has a longer range and a more penetrating effect than the fog stream; thus, the advantages of the straight stream are its *__________ and more *__________.
longer range penetrating effect	180. Two advantages of the straight stream are *__________ and more *__________.
longer range penetrating effect	181. The straight stream has little water surface exposed to the heat, as compared to the fog stream; thus, a disadvantage of the straight stream is *__________.
little water surface exposed to to the heat	182. Two advantages of a straight stream are its **__________ while the disadvantage is **__________.
longer range and more penetrating effect little water surface exposed to heat	183. Capacity means the amount of water that can be delivered under specified conditions. Therefore, the capacity of a fire stream is the amount of *__________.
water that can be delivered under specified conditions	184. Under specified conditions, capacity means *__________.

the amount of water that can be delivered	185. The size of the nozzle must be considered when figuring the capacity of a fire stream. When figuring the capacity of a fire stream we must consider the *______________________________.
size of the nozzle	186. One of two things taken into consideration when figuring the capacity of a fire stream is the *__________________________________.
size of the nozzle	187. You wish to know the capacity of a fire stream. One thing you must take into account is *____________________.
the size of the nozzle	188. Velocity of water, refers to the speed of the water. If the speed of the water in a hose is 10 feet per second, then this will be its _____________ ________________________.
velocity	189. The capacity of a fire stream is determined by the *_______________ and *_____________________________.
size of the nozzle and velocity of the water	190. If water is moving at a rate of 100 feet per second through a 2 1/2 inch hose, this rate or speed of the water is called _____________________.
velocity	191. To determine the capacity of a fire stream we must know the speed or _____________ of the water and the *________________________________.
velocity of the nozzle	192. The size of the __________ and the ____________ of the water will determine the ________________ of a fire stream.
nozzle velocity (speed) capacity	193. When determining the capacity of a fire stream we must know two things, one of which is the size of the nozzle the other is the *____________________.
velocity of the water	194. Pressure exerted against the intake side of the pump is called intake pressure, while pressure exerted back against the discharge side of the pump is called back _____________________________.
pressure	195. The pressure exerted back against the pump is called *_________________.

back pressure

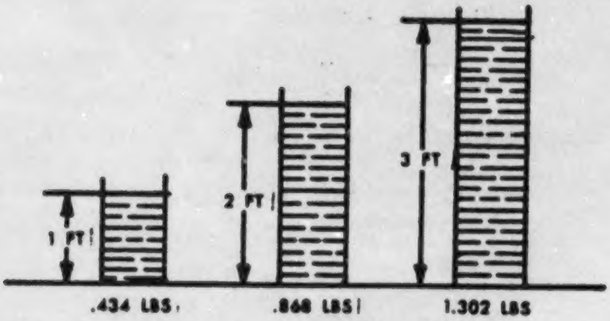
196. Back pressure is caused by the weight of water forcing back against the pump; thus, any pressure caused by the ______________ of the water forcing ______________ against the pump is called *__________________________.

weight
back
back pressure

197. Back pressure is caused by the weight of ____________ forcing *_______ ________________________.

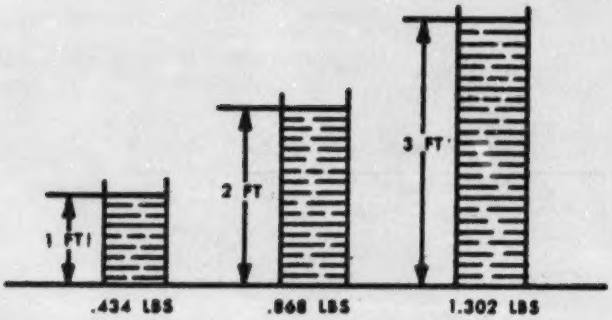
water
back against the pump

198. Back pressure is figured by the weight and height of the water. From the figure below if the water is raised 6 feet there would be a *________ ________________ of ____________ psi.



back pressure
2.604

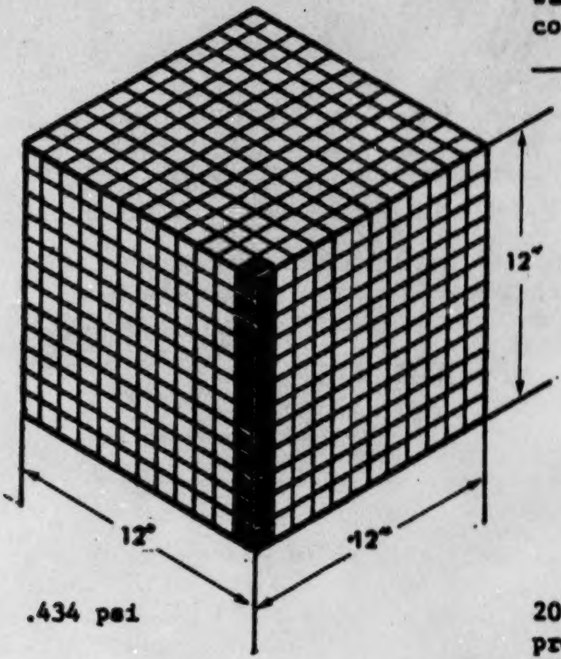
199. From the figure below, if the water is 1 foot above the pump it would have a *_________________ of ____________psi.



back pressure
.434

200. For each foot water rises in the hose, pressure will be exerted back against the pump in the amount of *___________.

.434	201. This figure shows 144 columns of water 1 foot high (12 x 12 = 144). Each column will exert a downward pressure of ____________________________________.



.434 psi	202. When drafting water, the amount of pressure decrease needed in the suction hose to raise water 1 foot is *________ ___________________.
.434 psi	203. If pressure must be decreased in the suction hose .434 psi to raise water 1 foot the water must exert a downward pressure of *_____________ per foot.
.434 psi	204. If water is raised 12 feet (about 1 story) above the pump, then to figure the *______________ we must multiply 12 feet x *____________________.
back pressure .434 psi	205. For each 12 feet the water rises above the pump, we will have 5.208 psi of *________________. We adjust the figure 5.208 psi to 5 psi for easier use; thus 5 psi becomes a *____________.
back pressure rule of thumb	206. The RT for back pressure per each 12 feet of rise above the pump is *___________________________________.
5 psi	207. When figuring back pressure we never figure the first story of a building. Therefore, if the nozzle is raised to the second story we will have only *_________ ______of *__________________________.

5 psi back pressure	208. The RT back pressure per each 12 feet of rise is 5 psi. Therefore, if the nozzle is raised 4 stories or 36 feet above the pump, the *________ will be *__________________________.
back pressure 15 psi	209. To overcome back pressure we increase pump pressure. If the nozzle is raised to the third story, we will have ______________ psi of ____________ and to overcome this, we *______________.
10 back pressure increase pump pressure	210. To overcome back pressure we must *__________________________________.
increase pump pressure	211. The increase in pump pressure must be equal to the amount of back pressure. If our back pressure is 15 psi we must *________________ in the amount of *______________ to maintain standard *__________________________.
increase pump pressure 15 psi nozzle pressure	212. Back pressure is never figured for less than 5 psi. In other words, if the nozzle is raised only 6 feet above the pump, we would ____________ figure any *__________________________________.
not back pressure	213. If the nozzle is not raised at least 12 feet above the pump you would _______ figure *__________________________.
not back pressure	214. If the nozzle is carried to the 5th floor of a building, the back pressure would be *___________ and to overcome this we must *________________ in the amount of *__________________________.
20 psi increase pump pressure 20 psi	215. Back pressure is **______________ and is overcome by **____________________.
the weight of the water forcing back against the pump increase pump pressure	216. The fire department has numerous sources from which it gets water. Of these the most common is the fire hydrant. The most common water supply is the *__________ ____.
fire hydrant	217. The most common water source used by the majority of fire departments is the *__________________________________.
fire hydrant	